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BY

LYNN HAROLD HOUGH

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PERSONALITY *and* SCIENCE
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TO THE MINISTERS
OF THE
UNITED CHURCH OF CANADA

WITH PROFOUND APPRECIATION
OF THEIR GENEROUS FRIENDLINESS AND
UNSTINTED KINDNESS

The Ayer Lectures of the Colgate-Rochester Divinity School
Rochester, New York

The Ayer Lectureship was founded in May, 1928, in the Rochester Theological Seminary, by the gift of twenty-five thousand dollars from Mr. and Mrs. Wilfred W. Fry, of Camden, New Jersey, to perpetuate the memory of Mrs. Fry's father, the late Mr. Francis Wayland Ayer. At the time of his death Mr. Ayer was president of the corporation which maintained the Rochester Theological Seminary.

Shortly after the establishment of the Lectureship, the Rochester Theological Seminary and the Colgate Theological Seminary were united under the name of the Colgate-Rochester Divinity School. It is under the auspices of this institution that the Ayer Lectures are given.

Under the terms of the Foundation the lectures are to fall within the broad field of the history or interpretation of the Christian religion and message. It is the desire of those connected with the establishment and administration of the Lectureship that the lectures shall be religiously constructive and shall help in the building of Christian faith.

Five lectures are to be given each year at the Colgate-Rochester Divinity School at Rochester, New York, and these lectures are to be published in book form within one year after the time of their delivery. They will be known as the Ayer Lectures.

The lecturer for the year 1928-29 was Professor Willard Learoyd Sperry, D.D., Dean of the Theological School in Harvard University. The lectures have been published under the title, *Signs of These Times.*

The lecturer for the year 1929-30 was the Reverend Lynn Harold Hough, Th.D., D.D., Litt.D., LL.D., pastor of the American Presbyterian Church, of the United Church of Canada, Montreal.

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A WORD OF INTRODUCTION

IT WAS said of that very brilliant man of letters, Sir William Robertson Nicoll, that with all his amazing erudition, he had paid little attention to the vast literature which was being produced as a result of scientific studies. One of the heartening features of the present situation to those who believe in a synthesis of knowledge as a goal for all our mental efforts, is to be found in the fashion in which busy ministers, with all the complex demands of powerful churches pressing upon them, are finding time to read, master and inwardly digest the utterances which speak with any sort of secure authority in the scientific field. In the United States a brilliant group of young ministers, who occupy positions of authentic intellectual leadership from New York to the Pacific Coast, have this characteristic in common. Perhaps it is not quite so true that the able young men who are doing memorable work in the physical and biological sciences have anything like an easy mastery of the most important materials in philosophic and religious thought. The recent publication by the Cambridge University Press, of Mr. William Cecil Dampier-Whetham's *His-*

tory of Science—perhaps the best discussion of the subject in one volume in the English language—does, however, show what new possibilities open before the mind which moves with assurance both in the fields of scientific and of philosophic thought.

Something over thirty years ago I became interested in that type of critical philosophy which surveys the materials of experience from the standpoint of the central significance of personality. With increasing satisfaction as the years have gone on, I have used this approach to the problems of contemporary thought as these have been affected by the physical and biological sciences. And now the Ayer lectureship at the Colgate-Rochester Divinity School has given me the opportunity to set forth in somewhat formal fashion the result of a good many years of mental grapple. That I am in debt to many clear and penetrating thinkers goes without saying. I have tried in the bibliographies and the notes at least to suggest the extent and the sources of this obligation, as well as to refer to some of the literature which has set forth with definiteness and clarity positions to which I have been unable to give my assent. My warm thanks are due to the president and faculty of Colgate-Rochester Divinity School for many courtesies. I also wish to record my appreciation of the care with which my secretary, Miss Martha M. Cook, has prepared the manuscript for publication.

LYNN HAROLD HOUGH

PERSONALITY
AND
SCIENCE

CHAPTER I

SCIENCE AS AN ACHIEVEMENT OF PERSONALITY

THERE is a famous *bon mot* of M. Clemenceau: "Poincaré knows everything and understands nothing. Briand knows nothing and understands everything." Without pronouncing judgment upon this epigrammatic appraisal of two distinguished Frenchmen, one may be allowed to say that there is a good deal of difference between knowledge and understanding. Knowledge may lie dead in the mind. It may be the protective covering of an inner ignorance. It may be tossed about in the mind like the objects in an old curiosity shop. Or most baffling of all, it may be brilliantly classified in such a way that there is no suggestion of its ultimate significance. It is not merely a little knowledge that is a dangerous thing. Knowledge whose significance is misinterpreted or misunderstood is most dangerous of all. When men are able to announce boldly indubitable facts, they have an odd way of believing that their own interpretations of these facts show the unquestioned quality of the facts themselves.

Science has been responsible for a good many discredited philosophies. An interpretation which is a good tool for the next step in chemistry does not always turn out to be a good principle for the interpretation of the universe. So it turns out that the discovery of the relation of scientific knowledge to the understanding of life is one of the most demanding and urgent tasks confronting the human mind in a scientific age.

The most remarkable fact about science is the scientist. There is, of course, also the body of material with which he deals. No one can deny its significance. Many people become so engrossed with this material that they quite forget the masterful mind which organizes its elements in such fashion that they attain unity and order. We study the sciences quite objectively. So it is natural that physics should seem more important than the physicist, and chemistry should seem more important than the chemist, and that biology should seem more important than the biologist. It is only when we begin to study the history of the physical sciences and the history of the biological sciences that we begin to realize that separately and together they represent the achievement of the clear intelligence of the scientific mind. Without the scientist there would be no science.

We see how important this is when we come to realize that no end of busy workers have been so engrossed with the uniformities which the scientist has discovered in nature, that they have quite forgotten the darting and free moving intelligence of the scientist who does the discovering. And quite often they have built up large generalizations regarding science with the scientist left out. They have come to views of reality which have ignored and then forgotten and then in effect denied the existence of the cool and masterful intelligence of the scientist himself.

A great many people have become seriously discontented in the presence of the mechanical world which has often been presented to them as the last achievement of scientific perception. And sometimes when they have become angry they have attacked science. Then they have gone to other disciplines and through a brilliant metaphysic, or a penetrating theory of knowledge, or a profound theology, they have sought to build themselves into an impregnable position. I have only respect for the massive and sterling work which they have done. But I suspect that there is a more strategic way of dealing with the whole situation. I suspect that the wounds of science may be healed by more science. I believe that when once we have come to view science in the proper perspective with the scientist at the center of the picture, everything will fall into proper proportions. Indeed, the full meaning of science can only be understood if at every moment the keen and critical intelligence of the scientist's mind is kept before our attention. A study of the whole scientific adventure will save us from parochial and mechanical views of science. Indeed, the moment we forget the mind of the scientist and try to build a view of reality based only upon the materials with which he deals, we are sure to go wrong. He is an essential part of that reality which we would like to understand. Indeed, but for him the materials would lie about unclassified and ununderstood. It is amazing and indeed glorious to live in a world whose elements can be classified and organized into some sort of intellectual coherence. It is even more amazing, even more glorious to live in a world inhabited by beings who can fathom nature's secrets and follow to unseen and far-off places the most inaccessible facts and bring them forth triumphantly so that the light of comprehending intelligence falls upon them.

We desire then to inspect the scientist. We desire to learn what kind of assertions we must make about a world which feels the power of his inspecting and critical scrutiny. We desire to see the way in which science has come to be the accomplishment of that most significant individual, the scientist. It is in this fashion that we approach the study of science as an achievement of personality.

I

Edwin Muir has a clever sentence somewhere in *Latitudes* to the effect that the use of a system is that it thinks for one. If you accept some neat and well-arranged system of thought you find your mind nicely made up on numerous subjects. The difficulty confronted by the founders of science was just that there was no system. They were not preceded by men who had done their thinking for them. They had to think for themselves. When men first began to deal with experience in such a way that they could rise from experience to knowledge, and when they began to invent instruments for the expression of that knowledge, science was born. If primitive men expressed the number five by a word which meant "a whole hand" and the number ten by words which meant "both hands," and the number fifteen by a word which meant "a whole foot," the number twenty by a word which meant the equivalent of "one Indian," the number forty by "two Indians" and so on and on, you had an action of the observing and classifying mind which is of the utmost significance. All calculation rests down on such beginnings. They may seem humble. But in such mental action you perceive already the essential difference between a thing and a person. What is to become critical intelligence is right robustly at work in the world in these simple beginnings of counting.

In the Tigris and Euphrates valleys there were the clear and shining stars upon which the eyes of dim and far-off men gazed night after night. But the flash of a sharp point of distant radiance upon the optics does not necessarily mean either thought or observation. That is just the difference as Carlyle remarked centuries later, between Newton and Newton's dog Diamond. The men in the Tigris and Euphrates valleys did observe. They did classify. They did make a world in the sky with their minds. They traced highways among the stars with their thoughts. They amassed a sound body of information ready for the use of later and more profound investigators. The sight of the stars started something in their minds. Numbers of dumb beasts stood about them as they sent their curious minds out among the stars. The eyes of the dumb beasts were eyes and nothing more. But the human watchers of the night skies brought something to the stars which made all the difference. By and by, it was to become the ample achievement of the notable science of astronomy. That power to observe and to classify and to remember is as important as any facts lying hidden among the stars. The seeds of scientific achievement in their own minds are really the most significant matters which the memory of these ancient star gazers bring to our thought as we look back upon them.

The Valley of the Nile has its own fascinating tale to tell. When the rising river had retreated to its banks, landmarks were washed away in the most disconcerting fashion. What could be done about it? Of course unless you have some sort of restless and growing intelligence in Egypt, nothing can be done about it. But if you have minds which play about all sides of subjects, puzzling and thinking and thinking and puzzling, a good deal may be done about it. And in the Valley of the Nile you did have just such minds. And thus in a practical fashion geometry was born.

So we must think of early men looking at each other's fingers and reaching the wholly astonishing conclusion that a man might have as many sheep as he had fingers on his hand and at last reaching the dizzy height of thinking of numbers quite apart from the thing numbered. When a man could say two without saying two men or two trees his mind had moved into a new world. So we must think of early night watchers putting the stars and their motions in neat receptacles in their minds and teaching memory to carry unwonted burdens. So we must think of early men watching the receding waters of the Nile and teasing their minds into a new sort of activity until they work out methods for finding the place of vanished landmarks. It is all startling enough. It is as if nature has learned to look at itself, and call itself names, and hide away its knowledge of itself, and darting about in some queer way to become a master of its own forces. Something like this lies at the beginning of science. And this personal fact of the action of intelligence is the matter we must not forget for a moment either at the beginning or during the whole long history of scientific achievement.

II

In his Harvard lectures on the Originality of Greece, Professor S. H. Butcher quoted Democritus as saying "Rather would I discover the cause of one fact than become the King of the Romans." The reader of that forceful presentation of significant facts *The Legacy of Greece* which R. W. Livingstone has edited is prepared for the sense of cultural inheritance which grows upon him as he reads the volume. But unless he has made ample previous investigation he will scarcely be prepared for the place which really must be ascribed to Greece in the development of science. The analysis of the meaning of the activities of the mind in setting forth its experiences in logical relationships was done, and one may almost say done once for all, by great Greeks whose work came to happy consummation in Aristotle. The achievement of the Greeks in mathematics fairly startles us. They were all the while standing back from facts and seeing relationships. "Greek geometry," says Professor Butcher, "was . . . a new thing in the history of the human mind. Geometry, according to Herodotus, was born in Egypt; but it was geometry as an applied science, practical in its aims, and such as was requisite for the acts of building and land surveying. Theoretic geometry the Greeks created for themselves, and so rapid was their advance that by the fifth century B.C. as it would seem, the greater part of what is contained in the elements of Euclid had attained to demonstrative and logical form."[1] In logic we see the mind inspecting its own utensils. In mathematics we see the mind inspecting relationships which stand in their own right quite apart from the objects or activities to which they are applied. Mathematics is rationality becoming conscious of its own implications.

Logic is related to every scientific discovery. And there is a sense in which you can almost say that the history of mathematics is the history of science. So when the Greeks were dealing with these fundamental matters they were both doing scientific work and making the structure of the sciences possible. And in every stage of this work you see the activity of the perceiving, analyzing, appraising mind. Logic is the mind investigating the nature of proof and analyzing the process of dialectic. Mathematics is the mind perceiving the relationships which are structural in rationality itself. From the beginnings of surveying to the last mathematical calculation of Einstein science has rested upon the mathematical relationships which the appraising mind has discovered. And that sense of cause and that tendency to ask "why" so characteristic of Greek intelligence

[1] Harvard Lectures on *The Originality of Greece,* p. 103.

lie back of an enormous body of scientific enquiry and the resulting achievement.

We are not surprised that as Professor D'Arcy W. Thompson has reminded us, chemistry, mechanics and engineering are absent altogether from Greek activities. But we are likely to be surprised at the extent and importance of the Greek interest and achievement in biology and medicine. Charles Singer, lecturer on the History of Medicine in University College in London, feels that he dares to say "Modern medicine may be truly described as in essence a creation of the Greeks."[2] The Greeks, in short, did observe and classify facts in relation to living forms and the human organism. They did set going a great science like medicine upon lines which have proved permanently fruitful. The type of intelligence which appeared in the great cultural achievements of fifth century Athens, was also able to lay the foundations upon which the physical and the biological sciences one day would be able to build.

When Matthew Arnold died an energetic admirer said "There goes our last Greek." But as a matter of fact as long as scientists continue to do their work among us there will still be Greeks walking about in our streets. Sometimes the scientist has lost the

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[2] Article on Medicine by Charles Singer, in *The Legacy of Greece* (Livingstone), p. 248.

Greek urbanity. But the mental instruments which he simply must use are a gift of Greece.

When Thales set about finding one element whose changing forms would be as manifold as the aspects of life, a notably seminal form of investigating intelligence was at work. "Here," said Thales in effect, "is water. When it is cold you have a solid, when it is warm you have a liquid, when it is hot you have a gas. Water is the fundamental element. It takes upon itself the typical and essential forms of existence." To be wrong in so potent and promising a way was better than to be right in a smaller fashion. The mind which sought unity in the midst of diversity was already on the highroad to tremendous achievement. When the Eleatics spoke of substance, when Heroclitus spoke of change, when the reconciling Democritus spoke of atoms unchanging themselves but changing in their relations, the type of intelligence which was being developed had the promise of the whole future of science in it.

When Greek thinkers sending forth the rays of their darting minds conceived of evolution before the days when it was possible to put evolution upon a sound inductive basis, already it was clear that science could be thought as well as observation. The Greeks forged weapons which were to be used by science in many a century.

The thing for which we use the word "personality," came to singular and brilliant expression among the Greeks. And when the Greek was most a person of clear and observing intelligence he did most to lay the foundations of science.

III

In Professor Irwin Edman's fascinating book *Richard Kane Looks at Life* a sentence is quoted from a Japanese poem: "In this edifice of civilization which has taken so many hundred years to build, I drive one golden nail."[3] As one studies the brilliant days in Alexandria beginning with its founding in the fourth century B.C., one sees many of the nails being driven in the structure of a growing knowledge. "Here for the next seven hundred years Greek science had its chief abiding place. The fame of Alexandria soon outshone and eventually eclipsed that of Athens, while Romans journeyed from Rome—never important in ancient times as a scientific center—to study at Alexandria the healing art, anatomy, mathematical science, geography and astronomy."[4] It was not in vain that Alexander the Great had been taught by Aristotle. Wherever his armies went the spirit of scientific observation was carried. Vast was the knowledge of natural history and of geography which was garnered in while his soldiers marched and fought. This scientific spirit came to dwell in the city founded by the great conqueror at the mouth of the Nile and bearing his own proud name. Over four hundred thousand volumes were collected in the library of the museum—the largest library of the ancient world. Here men worked and thought and wrote. Here they brought the results of their observation and their thought. Here Euclid made his name synonymous with the development of mathematics. Here Claudius Ptolemaus (Ptolemy) made himself a master of men's thoughts about astronomy and reigned from his tomb over the minds of living men for over a thousand years. Here Archimedes made principles seem things of magic as he applied them to mechanics.[5] If mathematics now move dizzily into non-Euclidean regions, these far flights would be impossible without the body of mathematical perception unfolded by Euclid. And if we now smile at the almost endless epicycles with the earth at the center of the system which we associate with Ptolemy, we marvel at the mathematical ingenuity which on this basis worked out computations which did answer to the varied spectacles which confronted the observer of the night sky. Even the mistakes of scientists—and here Ptolemy takes outstanding rank—have tremendous significance in respect of our understanding the reality which the history of science brings within our ken. The power to make mistakes, the power to make them brilliantly and with commanding intellectual energy, the capacity after centuries of dull acceptance and periods of keen intellectual struggle to find the mistakes and correct them, the capacity to come back to the facts with ever quickened and resilient mind and to pounce upon the truth at last: all these reveal the intelligence of the scientist in disconcerting and significant ways. It is not a rigid and mechanical world in which such feats are possible. The very mistakes of the scientist prove that there is free moving intelligence in the world.

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[3] Page 50.

[4] Sedgwick and Tyler, A Short History of Science, p. 87.

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[5] Archimedes studied in Alexandria though most of his life was spent in Syracuse. He represents the Alexandrian tradition.

Archimedes gives us dramatic illustrations of the development of science as a personal achievement. Contemplate for a moment Archimedes in the bathtub. The forces of nature are all about him going their own way seeming to be impersonal and almost inscrutable. Archimedes is thinking with puckered brow. How will he discern whether the king's crown is pure gold? He steps into the bathtub. The water rises and overflows. Suddenly the brow of Archimedes clears. Suppose you put the king's crown into the water and then see how high the water rises. Suppose you put gold of the same weight into the water and see how high it rises. Suppose you put silver of the same weight into the water and observe its rising again. If the displacement after the king's crown is immersed is between that of the gold and the silver of the same weight you will have discovered the presence of silver alloy. No wonder Archimedes leaped from the bathtub and rushed forth crying "Eureka! Eureka!" (I have found it! I have found it!) And so he discovered a culprit's work and so he discovered the law of specific gravity. But think of the exploring intelligence which set sail in a bathtub and made such a discovery. We are interested in the law which Archimedes discovered. And if we are really discerning we are interested quite as much in the mind which made the discovery. When we think of the total reality which experience reveals we must think of laws like that which Archimedes discovered. We must also think of the exploring darting intelligence which makes the discovery.

IV

Philip Guedalla says somewhere that it is always delightful to meet a piece of art that has come to life. A good many people would probably feel that no more than this can come from a study of the Middle Ages. Here we may be told is a happy hunting ground for artists and dreamers. But here the scientist may carry his gun all day without having an opportunity to fire a shot. Indeed, Newton and his contemporaries in the seventeenth century began pretty much where Archimedes had left off in the third century B.C. Not much to take seriously had happened for upwards of two thousand years.

As a matter of fact, of course, the matter is not so simple as such words as these would indicate. Professor Alfred North Whitehead brings us to a sudden stop when he declares in his Lowell Lectures for 1925 on Science and the Modern World, "The faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivation from medieval theology."[6] "The Middle Ages" he says, "formed one long training of the intellect of Western Europe in the sense of order."[7] And probably some readers will be still more surprised at his statement: "The alliance of science with technology, by which learning is kept in contact with irreducible and stubborn facts, owes much to the practical bent of the early Benedictines."[8] All this goes to show that the Middle Ages do not represent a series of blank pages in respect of the history of science. Scholasticism created the mind with the almost dramatic sense of orderly relationships whose assumptions are fundamental for all the work of modern science. It built up that foundation of implicit convictions upon which experimental scientists have continued to work. And it did this work by means of its own fairly microscopic inspection of orderly relationships. The bent toward this sort of thing came largely from Aristotle, and so we find Professor Whitehead saying: "Galileo owes more to Aristotle than appears on the surface of his Dialogues, he owes to him his clear head and his analytic mind."[9]

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[6] *Science and the Modern World,* p. 19.

[7] *Ibid.,* p. 17.

[8] *Ibid.,* p. 22.

That intellectual adventure which was based upon the fascinated sense of the endless relationships involved in sound argument filled the Middle Ages with a joy it is hard for a modern to understand. But it crystallized into those assumptions which we accept without analysis and use without gratitude. And these very assumptions brought to experimental activity make the natural sciences possible. If the medieval period is only a stepmother of the inductive sciences, that stepmother at least trained its charge in a school whose intellectual discipline prepared that charge for his most characteristic achievements. The organization of medieval study in the Trivium and the Quadrivium shows the technique of this training. The Trivium introduced the student to the study of speech (grammar); of argument (dialectic); and of persuasion and beautiful speech (rhetoric). The Quadrivium led the student to the calculations dealing directly with numbers (arithmetic); the calculations dealing with sound (music); the calculations dealing with surfaces and solids (geometry); and the calculations dealing with heavenly bodies (astronomy). The queen of all the sciences (theology) brought one to the supreme cause, and that sense of the ultimate causality got into the very fiber of the thought of Europe. This sense of causality gave a turn to the thought of men as they scrutinized their observations. And so theology in an odd way became the mother of science. But it is not too much to say that the whole process of medieval training was a pedagogue leading Europe toward that scientific accomplishment which as yet lay in the shadows of the future. When you think of the Middle Ages you are fairly sure to think of Saint Francis. You are not quite sure to think of Roger Bacon. But if Wycliffe is the morning star of the Reformation, Roger Bacon is the morning star of modern science. The thirteenth century saw the activities of both Saint Francis and Roger Bacon. The one set Europe to singing in quite a new fashion. The other set Europe to thinking in quite a new way. Roger Bacon was an Englishman who studied at the then young University of Oxford. He received his doctor's degree at the University of Paris and himself was a member of the Franciscan order. He spent a good deal of his life in prison or its equivalent. He observed and studied and thought and passed into a new world where he used his scholastically trained mind for activities of which a typical schoolman would never have dreamed. He apprehended the possibilities which lay in the field of experiment. He knew of a formula for the composition of gunpowder. He was acquainted with the use of lenses and mirrors of spherical shape. He knew how telescopes and microscopes could be made, if he did not make them. He influenced Columbus by what he said about oceanic distances. He prophesied ships mechanically driven and carriages propelled without horses. In him you see the logic of the Middle Ages beginning to be set to the uses of observation and experiment. And at once you see what tremendous possibilities are emerging.

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[9] *Ibid.*, p. 18.

In this whole period you see intelligence too often turned in upon itself, always brilliantly active, if sometimes active about mental cobwebs, and at last finding objects into which its teeth may bite. When the great days of attacking nature directly come, the mind has been made into a fine instrument ready for its work. Personality stands at the door looking directly at last upon the physical world about it, and so standing it is ready to use the new materials as they could never have been used without the intellectual discipline of the Middle Ages.

V

There is an old melody which sometimes sounds in my ear taking to itself the words with which it is associated in my mind:

Oh, Italia, Italia beloved
Land of beauty and sunlight and song,
Though afar from thy bright skies removed
Still our fond hearts for thee ever long.

When we think of the Renaissance we are likely to think of this aspect of the life of Italy and of all the new sense of beauty which came to flowering time in the world. And even when we think of Leonardo da Vinci we are likely to remember Walter Pater's amazing description of his "Mona Lisa": "All the thoughts and experiences of the world have etched and moulded there, in that which they have of power to refine and make expressive the outward form, the animalism of Greece, the lust of Rome, the mysticism of the Middle Ages with its spiritual ambition and imaginative loves, the return of the Pagan world, the sins of the Borgias. She is older than the rocks among which she sits; like the vampire, she has been dead many times and learned the secrets of the grave; and has been a diver in deep seas and keeps their fallen day about her; and trafficked for strange webs with Eastern merchants; and as Leda, the mother of Helen of Troy, and as Saint Anne, the mother of Mary; and all this has been to her but as the sound of lyres and flutes and lives only in the delicacy with which it has moulded the changing lineaments and tinged the eyelids and the hands."[10] All this may well be in our minds when we think of Leonardo. But more than all this should be in our minds. For Leonardo was also a scientist. That crystal clear mind of his was a medium through which he looked upon one field after another. He saw the significance of experiment. He saw before their day principles demonstrated by later scientists. In the study of motion his mind went to the heart of questions he considered with singular sharpness of perception. Whèn he considered fossils he anticipated judgments reached centuries later. Anatomy and physiology claimed his intimate interest. It is said that had his work been published science would have advanced in one step to the place it reached a century after his time. Here you have a mind which justifies Paul Valéry's fascinated scrutiny. Here indeed you have "L'Homme Universal." And as we think of his scientific activities we see again quick, and clear, and free moving intelligence about the tasks of understanding the forces which move through this amazing world. You begin to feel that the world has waited to be comprehended by men like Leonardo—artist and scientist as well, and far better scientist because of his artistic power.

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[10] Walter Pater, *The Renaissance*, p. 130.

But the man of the period of the Renaissance who really changed the universe for all of us was Nicholas Copernicus. He graduated at Cracow, receiving the doctor's degree in arts and in medicine as well. He studied at Bologna. He was in Rome and at

Padua. His uncle was Bishop of Frauenburg. Here he lived a life of devotion to spiritual exercises, to the care of the sick and to that study and contemplation which were to give a new universe to the sons of men. Greatest as an astronomer, he achieved his commanding position not so much by the observation of the planets as by a study of the meaning of the mathematics involved in stellar motion. That the earth was the center around which the whole sweeping series of heavenly bodies moved every twenty-four hours he was less and less able to believe. What if the earth did the rotating? Patiently he worked upon his materials and in 1543, the year of his death, *De Revolutionibus Orbium Cœlestium* (*The Revolutions of the Celestial Orbs*) was published. Here at last was the proof that the sun is central in the solar system. And here once more it is the patient, studious, calculating mind of Copernicus to which we would call very special attention. The subtlest powers of personal criticism and personal intelligence are involved in the work of Copernicus. If the earth lost its proud position of centrality through the work of this daring thinker, the mind of man gained correspondingly in high distinction. For the mind which could put the sun and the planets in their places is a phenomenon of fairly staggering significance. If the earth surrendered to the sun, the whole solar system surrendered to Copernicus.

In the sixteenth and seventeenth centuries Francis Bacon did his epoch-making work in respect of the method of the mind in conducting its processes of investigation. The inductive method did not come into existence only as the result of the work of Francis Bacon. But it did attain a clear and commanding position as a result of his cogent thinking and masterful exposition which gave it a place in men's minds quite unknown before. The conception of a study which masters the facts, and then rises to dependable generalizations, was henceforth to haunt the minds of men. Francis Bacon is even more a philosopher discussing the methods of science than he is a scientist. But his discussion reveals once again the curious mind working out a technique by which it may reach dependable conclusions regarding the world it inhabits.

Altogether a new world in which science was to do its great work had come into being before the waning of the lights of the Renaissance. And the new world was the discovery, in some respects the creation, of the phenomenal intelligence of man.

VI

Sainte-Beuve remarks somewhere that there is no recipe for making classics. I suppose the remark may be extended so that it will include the achievements which we ascribe to science. It is clear, however, that in some periods scientific activity does thrive and come to a certain ample quality of productiveness. The seventeenth century, for instance, was a period when much was going on in that realm where the physical sciences control the most wide and varied territory.

John Kepler, who turned observations into laws and did indeed unlock the secrets of the heavens, would have given distinction to any century. To be sure he was preceded by Tycho Brahe whose career had its own storm and stress and its own brilliant achievement. Tycho Brahe was not a thinker. But he was a master in the matter of getting possession of the facts. Ivor B. Hart, in *Makers of Science,* says of him, "Tycho Brahe may justly be termed the pioneer of accurate astronomical observation." When we join his name with that of Kepler we think of one as the observer and of the other as the mathematical thinker. The two give a splendid example of united effort. For twenty years Tycho Brahe made observations and collected data. When the Rudolphine Tables were finally published by Kepler a new set of implements were in the possession of all those whose calculations had to do with the stars. But if Tycho Brahe was an observer of infinite patience and care, John Kepler was indeed a brilliant and daring thinker. He knew how to make tables of observations the basis of the most far-reaching generalizations. And so he reached those insights which we think of as the fundamental laws of planetary motion. He was sure of himself. Listen to his brave proud words: "The die is cast. The book is written to be read either now or by posterity, I care not which; it may well wait a century for a reader, as God has waited six thousand years for an observer." And as you think of these words, think also of his titanic labors. "Fancy to yourself the oceans of paper he must have covered with figures; the endless hours he spent at night, alone, in a badly furnished home, with an ill-smelling lamp or a sputtering candle throwing a dim light across his table. Sick for much of the time, in poverty all of the time—surrounded by confusion and war, he yet found time to carry through successfully, one of the most profound and involved computations known to science."[11]

Galileo Galilei has been called the founder of experimental science. You can watch him as a young man in the cathedral at Pisa observing the motion of the great lamps and keeping the time by counting his pulse and so discovering the law of the pendulum. You can watch him at the top of the famous leaning tower of Pisa dropping simultaneously two objects, one weighing a hundred pounds and the other weighing one pound. According to the Aristotelian principle the object weighing a hundred pounds ought to drop a hundred times as fast. The professors who watch the experiment below are sure that it will vindicate Aristotle. But the declaration of Galileo that the two will reach the ground together is amply proven by this dramatic experiment. You can watch Galileo as he looks through his telescope and so discovers the moons of Jupiter. And so you can follow him through more involved experiments and more subtle analysis. And all the while with Galileo as with Kepler the quality of intelligence which the scientist brings to his experiment and analysis and calculation is a matter of supreme importance. The significance of the free and potent and curious activity of the mind of Kepler and of the mind of Galileo is at the very heart of an understanding of their work. The temptation to be so occupied with the discovery that you forget to come to grips with the mental life of the discoverer is very natural. And it is very subtle. But that way lies an intellectual confusion which at length will work havoc with our whole thought of the universe.

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[11] Gross Wilson, *The Human Side of Science* (Cosmopolitan), p. 151.

Mr. Ivor B. Hart in his *Makers of Science* tells the fascinating tale of Picard's report to the Royal Society in 1682 of his more accurate apprehension in respect of the earth's radius. "Newton was present and he made a careful note of Picard's results. Immediately he began to recall his work and hopes of sixteen years ago. He hurried home and routed out his old papers and calculations on the subject. His excitement at the anticipation of complete success for his theory was too much for him. . . . The result was a complete triumph."[12] So the close observation of coöperating minds and the clear direct thinking of one master mind reached the understanding of the law of gravitation.

Brilliant French logicians soon reached the conclusion that the result of such potent computation as that of Newton was to make the universe a closed mechanical system. Sir Isaac himself was never beguiled by this sort of thinking. After all, to have a mechanical universe which is a closed system means that you must leave Newton out. There are undoubtedly mechanistic aspects which belong to the universe. But the existence of minds like that of Sir Isaac Newton prove that the mechanism is transcended. Really we could never know of the existence of such mechanical uniformities as the universe contains did not the universe make room for that free intelligence which is able to move all about the machine and observe its parts and learn their secrets. The scientist himself is the best sort of proof that the uniformities he discovers do not exhaust the meaning of the world in which these discoveries are made.

The great mathematical achievements of the seventeenth century with which we associate the names of Descartes, Leibnitz and Newton lead us farther along the road where the mind of the scientist and the rational relationships which he discovers are seen in their strategic meaning. The study of rational relationships and the experimental observation of the external world have gone hand in hand. In the mind of the scientist these two types of activity meet in notably productive fashion. So science is seen again as the achievement of the knowing mind daring to trust the validity of intelligence.

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[12] Page 160.

VII

Dr. Samuel Johnson somewhere in the *Lives of the English Poets* makes the observation, "The true genius is a mind of large general powers, accidentally determined to some particular direction." If there is truth in this assertion the accidents turned many first-class minds to scientific activity in the eighteenth century. Indeed, Lord Morley somewhere speaks of this century as the Scientific Renaissance. The matter is summed up in a sentence in Sedgwick and Tyler's *Short History of Science*: "It was in this century and especially in its latter half that chemistry, geology, botany, zoölogy and physics began to make a deep impression on the learned world, and astronomy and mathematics ventured upon bolder and more far-reaching generalizations than they had ever before made."[13]

The actual mental power of the scientist is clearly seen in his use of the critical faculty in dealing with false and inadequate theories. There was, for instance, the famous theory of "phlogiston." When you watch bodies burning it seems that something is escaping and the name given to this substance supposed to escape was phlogiston. But as a matter of fact when metals were burnt the solid resulting weighed more than before the burning. Here was a problem indeed, and a problem essentially for that critical intelligence which observes the physical uniformities and yet transcends them. It was Lavoisier, bearing in mind experiments of such men as Priestley and carrying through many experiments of his own, and thinking clearly about the significance of his discoveries, who reached the sound conclusion that no such substance as phlogiston exists. The unhesitating critical clarity of the mind which conducted such a process of reasoning on the basis of experimental data, brings us into the presence of the mind of the scientist in a particularly effective type of activity. And the sort of mind which discovers that phlogiston does not exist is a part of our data as we attempt to understand the world with which we have to do.

The work of Georges Louis Leclerc Buffon on natural history and the brilliant botanical classifi-

[13] Page 304.

cations of Karl Linnæus—the first a Frenchman, the second a Swede—may well represent the interest of the eighteenth century in the animal and vegetable life about us. Buffon was always on the trail of new and interesting facts. Linnæus was always seeking for sound and significant principles of classification. And in each type of mind you see the curious determined interest of man in his environment.

In the eighteenth century men look upon the rocks with a new sort of critical questioning. The battle between the Neptunists who believed that rocks were put down by water and the Vulcanists who believed that many rocks were produced by volcanic heat, by its very intensity, shows men pressing upon the facts, trying now by one hypothesis and now another for their explanation. Out of such belligerent battles of the enquiring mind men come to real knowledge at last.

The name of Benjamin Franklin at once suggests the wise and urbane diplomat astonishingly popular in the sophisticated circles of Paris, the keen and unhesitating patriot having his own share in the founding of a new Republic, and the daring experimental scientist willing to take genuine personal risks in order to add to the sum of knowledge. Everybody knows the dramatic story of Franklin's drawing lightning from the sky. But the direct and potent thought which lay back of the experiment and the solid process of reasoning which led to his report to the Royal Society are not always kept in mind. The conception of lightning as electricity moving from one cloud to another quite as an electric spark flashed from one substance to another was the result of a highly critical apparatus of intelligence, leading to skillful experiment and generalizing brilliantly from that experiment.

Laplace in 1796 published his *Système du Monde* and later his *Mécanique Céleste.* He discussed the nebular hypothesis which Kant had suggested forty years before. He used the principles of infinitesimal calculus to develop the understanding of the relationships of planetary motion. There is something rather diverting about his being so completely satisfied by the mechanical and mathematical relationships he discovered that the thought of an ultimate mind, it seemed to him, was unnecessary. For the clear and swift mathematical intelligence of Laplace itself transcended his vast mechanism; in fact, only by means of that intelligence was it possible to chart the uniformities of the great system. Here again if you remember the free and critical intelligence of the scientist you are saved from losing your way.

VIII

Philip Guedalla in his gay impudent fashion says that there is something the matter with the period in which Disraeli lived. "One may respect almost any Zeitgeist if only it will not wear ridiculous clothes. But when it comes with its head wreathed in wax flowers and its hands full of papier-mâché, casting mother of pearl before swine, enthusiasms are apt to grow a trifle faint; and even the collectors of bric-à-brac turn sadly in other directions. Which is the worst of great Victorians." All this is caustic enough and amusing enough. But it is well to remember that the period of which Mr. Guedalla is speaking was characterized by scientific achievements of the most startling and far-reaching character. You can almost take the publication of Darwin's *Origin of the Species* in 1859 as the great landmark dividing scientific activity into two periods. Everything before that year may be referred to as B.D. and everything after it as A.D. in quite a different sense from the usual connotation.

Contemplate for a moment Charles Darwin reading a discussion of population written by an Anglican clergyman and finding here a clue for the solution of one of the essential problems in the study of the fashion in which the forms of life became what they are. Think of his voyage around the world in the *Beagle*, of the twenty years of gathering and classifying of data, of the slow building up of the edifice of his thought. Once again contemplate Alfred Russel Wallace reading this same discussion by Malthus of problems connected with population and by a swift flash of imaginative insight reaching the same position to which Darwin had come. The whole story is full of dramatic interest and is a fine tale of the integrity and good will of two very real gentlemen. But the thing we are likely to miss especially as we follow the twenty years of patient investigation on the part of Darwin is the positively essential part played by his own mind in his discovery. We become so engrossed in the materials gathered together and effectively classified that the sense of the brooding, active intelligence at work all the while somehow is lost to our thought. But the tale of the epoch-making hypothesis of Darwin and Wallace is a tale involving qualities of freely moving thought and critical activity in the minds of the scientists which turn out to be of epochal significance. A good many people have gotten into strange bogs of confusion when they have thought of the doctrines of evolution leaving out of account the mental activity without which these doctrines could not have existed as a part of the history of science. When you think of *The Origin of the Species* you must not leave Darwin out.

Take a quite different matter. The planet Uranus had been discovered in 1781 by Sir William Herschel. But it had odd ways of its own and did not move as the theory of gravitation declared it ought to move. Toward the middle of the nineteenth century an English scientist, John Couch Adams, by a mathematical calculation determined that an unknown planet must be responsible for the odd movements of Uranus. A French astronomer, Leverrier, knowing nothing of Adams' work, worked out the problem. His calculations put the unknown planet within a degree of the determination of Adams. Then at the Berlin Observatory on September 23, 1846, M. Galle looked in the part of the sky Leverrier's calculations had suggested and found the unknown planet. So Neptune came within the knowledge of men. Here you have men in three countries combining mathematical calculations and observations and a planet new to minds of men surrenders its secret. Not often has science offered a more dramatic story to the student of its bewildering and sometimes dazzling activities. And here again the minds of the scientists stand at the very center of the achievement. It is to the free intelligence of the scientist that Neptune surrenders its secret. The mathematics involved tell a fascinating story. The mathematicians able to make calculations and to draw conclusions tell a more remarkable story still.

The central conception connected with the physical sciences in the nineteenth century was that of the conservation of energy. And here the paper of Helmholtz, written in his twenty-sixth year—*Ueber die Erhaltung der Kraft*—stands in a place all its own. Clerk Maxwell said of it: "To appreciate to the full the scientific value of Helmholtz' little essay on the conservation of force, we should have to ask those to whom we owe the greatest discoveries in thermo-dynamics and other branches of modern physics, how many times they have read it over and how often during their researches they felt the weighty statements of Helmholtz acting on their minds like an irresistible driving power."[14] And here again it is of the utmost importance that we remember the reasoning powers of the scientist as well as the principles he set forth. Then we will see clearly that his principles can never be used justly so to limit the system of things in which we live, move and have our being, as to make impossible the very free moving mental activity which discovered these principles.

IX

Then came the breakdown of the old physics as the nineteenth century moved into the twentieth. By breakdown we do not mean that the old formulas ceased to hold good in regions to which they had been applied. We mean that regions were discovered to which they did not apply. Professor Millikan gives us a vivid impression of the assurance of a famous physicist at the very end of the old régime. He felt that the fundamental discoveries in physics had been made. But soon the law of conservation of energy, the law of the conservation of mass, and

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[14] Murray, *Science and Scientists in the Nineteenth Century,* p. 96.

Maxwell's equations lost their absoluteness. It is a rather dizzy world upon which we now enter. Sir William Bragg declares that we use the classical theory on Mondays, Wednesdays and Fridays and the quantum theory on Tuesdays, Thursdays and Saturdays.[15] Whitehead describes the tense and dramatic hour when the returns from observation gave a new standing to the computations of Einstein. We are gravely told that the law of gravitation is a put-up job. We are introduced to a principle of indeterminacy at the very heart of such reality as we find in the physical world. We are inclined to make a rather wry face as we quote Dean Inge's

> We thought that lines were straight
>   And Euclid true
> God said "Let Einstein be"
>   Now all's askew.

But in the midst of jostling conceptions of time, space and all the new instruments for the expression of our sense of actuality in the physical world, the one remaining dependable feature of the situation is that cool and clear intelligence which invents formulas and uses them when they will work and casts them aside when they will not work and is fearless even in the presence of formal contradictions when two formulas prove able to do useful work.

We have only hinted at a few aspects of the long and varied and dramatic tale of the achievements of that person the scientist and that curious and darting and reasoning intelligence which is the fundamental fact in the history of science. There is no mental experience which properly understood will give one a profounder sense of the central position of personality, of rational intelligence, in the tale of the universe, than that involved in a careful survey of the history of science. Here at least personality sits on the throne.

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[15] Dampier-Whetham, *A History of Science,* p. 485.

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CHAPTER II

THE PERSONAL CONTROL OF THE WORLD WHICH SCIENCE HAS MADE KNOWN

ARTHUR CLUTTON-BROCK speaking somewhere of Keats says: "He was at home with ideas long before he was at home with people." The scientist likes to feel not so much that he is at home with ideas as that he is at home with facts. Of course, you can only deal with facts by means of ideas, but this it is quite easy to forget. The facts themselves are important enough. And we have already seen that the presence in the world of a person who can come to grips with these facts and can understand them is very important indeed.

But man does more than discover facts. He uses them. He bends them to his purpose. The history of the practical life of man is the story of his mastery of the forces of nature in such a fashion that they further his own purposes. The theoretical scientist no more than makes a discovery until the practical scientist emerges to ask if this discovery can be used to drive a machine, to do some sort of work, to make more secure man's mastery of the physical world in which he dwells. And if the activity of free and critical intelligence is the most important matter in the progress of science, the activity of a controlling mind—of a whole series of controlling minds—is the essentially significant matter in the development and in the activities of those practical arts which are based on science.

I

Some one has called Archimedes the first Yankee. His mechanical inventions were not so exciting to him as they were to his friends. But they are full of interest to us. And they all show that power of intelligent control which is at the heart of the practical arts. When Hiero the King had a ship which could not be launched Archimedes took the case in hand. That wise and practical mind of his had been working with the use of pulleys. And now he worked out a system using various pulleys and put the end of the long rope in the hand of the king. To the monarch's mystified delight the pulling of that rope by his own hand set the ship moving into the water. By and by Syracuse was at war with Rome. Once again Archimedes made his influence felt. He constructed great swinging cranes and actually seized Roman ships with them, lifted the ships straight into the air, and then let them fall and smash to pieces. He constructed great catapults and so hurled rocks against the Roman ships. For a long time in this fashion Rome and Archimedes fought. The matter we must keep clear in our thought is just the controlling mind of this brilliant thinker of Syracuse. Rome had materials enough. But Rome did not have the mind of Archimedes.

When Marcus Græcus in the ninth century declared that by mixing a pound of sulphur, two pounds of charcoal and six pounds of saltpeter, you would get a substance which would explode if you applied a light to it, and which was quite capable in the very act of explosion of driving things through the air, the mind seeking to control the forces of nature was actively at work. Gunpowder has had a checkered history. Indeed, the whole tale of explosives reeks with tragedy. But explosives have made their contribution to the welfare as well as to the suffering of human kind. And the explosive is the gift of that intelligent control which is all the while inspecting every element of this physical world and asking what can be done by means of it.

The method of printing by stationary types was successful in its own way but it was very crude and most cumbrous. The idea of using movable types had a revolution in its grasp. And that idea became a practical one in the fifteenth century. Shall we associate it with Lourens Janszoon Coster or with Johann Gutenberg? At all events the idea was held poised before the intelligence of a thoughtful man and was made practical. And in that day the wisdom of the ages already began to be within the reach of the common man.

Of course the intelligence of unknown thousands of men goes into any one of the practical arts. Take the matter of shipbuilding for instance. The triremes of the Mediterranean in the great days of Rome and the clipper ships on all the seven seas in the days of Napoleon tell a tale of endless human thought and ingenuity. No end of names get lost. But every step in advance has been the achievement of a clear and thoughtful mind which made that step possible. The man who idly sits and thinks may indeed sow a nobler crop than corn. Nature waits to obey him. The subtle and hidden forces of the world rise at his bidding. Personal control is the great word in all the practical arts.

II

Samuel Butler in his shrewd and cynical way in *Erewhon* tells of the wise destruction of the machines before they brought ruin to the world. As a matter of fact, of course, we have not destroyed the machines. They and their makers have thrived beyond the power of words to tell. They have brought blessing. We can scarcely deny that they have brought ruin too. But what is most clear of all is that the machine is the gift of man's curious and experimenting and thoughtful mind to the world. It is another triumph of intelligence controlling the forces of nature. Let us look for a moment at the story.

Dr. Black's investigations of problems connected with the study of heat were made at Glasgow just in time to stimulate the keen and intelligent mind of James Watt. So the steam engine and the steam age come within our view. In fact, during the latter part of the eighteenth and the beginning of the nineteenth century things happened with amazing rapidity. In 1764 James Hargreaves invented the spinning jenny. In 1771 Richard Arkwright invented the water frame. The best elements of these two inventions were combined in the "mule" by Samuel Crompton in 1779. The power loom was patented by Edmund Cartwright in 1784. The cotton gin came in the wake of Eli Whitney in 1793. Watt had produced a steam engine which would drive machinery by 1785. Fulton's steamboat sailed up the Hudson in 1807. Stephenson's locomotive was actually in action by 1814. So the old age politely and silently went away. So the new age came in with the driving energy of steam, the turning of wheels and the revolving of belts. One invention opened the way for another. But always there was the keen and persistent thought. Always there was the observing and experimentive mind. Not a pressure of steam does work but the mind of a man is behind it. Not a wheel turns but intelligence is the cause of the turning. The new transportation consisted of journeys in the minds of men before it became an endless number of journeys by sea and by land. The laboratory is an empty place until you have the mind of a man inside it. Neither clipper ships nor steam ships are anything apart from the intelligence which constructs them. We must not think merely of a few outstanding inventions when we are discussing the human controls which produced the age of steam. There are literally innumerable small inventions in respect of making the power of steam fully applicable and its utilization by means of machinery a reality. Somebody is all the while seeing new possibilities. Somebody is all the while turning these possibilities into actualities. There is a multitude of inventors whom no man can number. And at his own point each one of them applies clear and creative intelligence to the tasks of controlling the forces of nature. So at last the great ocean liners take to the sea. So at last the mighty locomotives carry great trains up steep mountain inclines. So the great factories become the homes of machines of a variety and complexity and potency fairly dazzling to the eye and confusing to the mind. And every bit of this is the achievement of curious, probing, observing, experimenting, forward-looking intelligence. The control of the forces which science has made known is a continuous and overwhelming achievement of personality. Given the truths of science as they were known in the eighteenth and nineteenth centuries, and the practical potency of the mind of man and the age of steam is inevitable.

III

Then there is electricity. Franklin is followed by Galvani who extorts great secrets from the nerves of a frog. Here comes Volta with his two metals placed in acid and water and his wire touching a battery at both ends. And so one after another the discoveries are made. Oersted proved that an electric current will cause a magnetic needle to move from side to side. Ampère proposed in 1830 to send signals by means of a magnet. In 1837 Wheatstone and Cooke patented an electric telegraph. During the same year Steinheil of Munich and Morse of America invented methods of electrical telegraphy. Here too the more abstract discoveries of scientists of one group were given a practical turn by genius of another order. Soon the land was dotted with telegraph poles and soon the sea itself became the servant of this new carrier of messages by means of electric current. The telephone captured the voice and carried it far away. The electric light with Edison in command turned night into day in great cities and in countrysides. Marconi flashed wireless messages across the sea. The development of the principles of radioactivity made it possible for one speaker to address a continent, then a series of continents. The power of man to control the subtle and implacable forces of nature seemed to have no limit. The problems connected with flight were studied and mastered. The air surrendered to the conquering mind of man. And in all this the intelligence of the man of science as a master of theory and experiment and the intelligence of the practical inventor who turned scientific principles to his own use worked together. Just as the most wonderful thing about science is the scientist, so the most wonderful thing about inventions is the inventor. Michael Pupin's *From Immigrant to Inventor* is full of the sheer, splendid romance of it. The boy in the steerage may unconsciously hold in his mind the capacity to find a secret for which the world is waiting.

IV

Stuart Chase says that the machine age has put a million wild horses at the disposal of the United States alone. "At the present time we can get a horsepower for every pound of metal in an aeroplane engine, while half a pint of gasoline will produce a horsepower for an hour. The old Watt engine produced a horsepower for every ton of metal. The improvement in energy per pound is thus something in the nature of two thousand to one."[1] "The other day I watched a rectangular figure fashioned like a cubist's nightmare, raise its arm when whistled to through a telephone. As the arm came up a mechanical piano began to play, a fan revolve, a washing machine bubble, while dial lights snapped on and off in the general region of his stomach. It was no other than Mr. Televox, the product of the Westinghouse laboratories, representing a late development in the automatic process. He will displace the skilled watcher of dials in power houses. The New York Edison Company recently opened an electric distributing station to be operated without a human being within its walls. Mr. Televox will be the only resident, requiring neither food, rest, nor sleep. He will be telephoned to from time to time by a living man, three miles away, and according to orders spoken or whistled, will break circuits, move levers, stop and start machines."[2]

All this answers to the need of an appetite which has been whetted for the dramatic. And the end is by no means in sight. But even the mechanical man has men of genuine and free intelligence back of him somewhere. The more startling the use of natural forces and energies, the more amazing is one's sense of the keenness of the mind which planned it all, and then carried out the plans. Every time you press a button you are using a capable human intelligence which saw through all the relationships which made possible the subtle response when that button is pressed. The more mechanical life becomes, the less mechanical is the intelligence which made the mechanism possible. If you judge the machine age by inventors, it is an age of supermen.

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[1] Stuart Chase, *Men and Machines* (Macmillan), p. 81.

[2] *Ibid.*, p. 106.

To be sure there is another side to the story. Mr. Arthur Pound in *The Iron Man in Industry* has called our attention to the tragedy of the automatic worker, who himself is in rapid process of becoming a machine. And in spite of all the clever arguments of Mr. Stuart Chase in his chapter on "Robots" in *Men and Machines,* I think we must confess that the situation has become baffling and difficult enough. The inventor and the master organizer surely have a notable experience of personal quality functioning in very high and potent fashion. But what about the men who become mere cogs in the great machine? What about the men whose personality is lost in vast organizations? I do not think we can brush them aside with a mere movement of the hand. We may surely say as much as this: The great organizer must use his powerful mind in such a fashion that the personality of the world is conserved at the very moment when the efficiency of its activities is increased. In the meantime we must not allow ourselves to forget the main point. We must keep steadily before our minds the fact that the machine age is the product of human controls. Without the mind of the inventor it would be impossible. Without the mind of the organizer it would be impossible. The fundamental word in the machine age is "personality."

The presence of personal intelligence always means that there is a possibility of making mistakes. There is a possibility of going the wrong way as well as of going the right way. The tale of our own period with its unparalleled production, its world-wide activities of transportation, and its monumental achievements in salesmanship is by no means simply a story of triumphant efficiency. Something of the other side of the story has been put by Mr. Stuart Chase into his book *The Tragedy of Waste,* in some ways a more searching study than that other volume *Men and Machines.* In this volume he makes the startling estimate that the man power in the United States going to the production of what Ruskin called illth (the opposite of wealth) is eight million; on any day there is an idle man power of six million; bad methods of production account for man power represented by the figure of four million and inadequate methods of distribution waste a man power of two and a half million. The total equals half the able-bodied population of the United States. On the basis of a study of waste, Mr. Hoover is said to have declared that coal is "the worst functioning industry in the country." And so one might go on—as Mr. Chase does go on. From the standpoint of our argument, it is important to see that all this waste is evidence of the personal factor. Intelligence is all the while working at these problems. It makes wrong decisions. It accepts inadequate solutions. It makes wrong choices. It adopts methods which prove to be less than the best. Its experimental activities are costly. Sometimes they are tragic. But they are not a matter of hard and inescapable fate. What was done in the wrong way may be done in the right way. An adequate solution may take the place of an inadequate solution. A satisfactory method may be put in the place of a method which is unsatisfactory. The technique of organization may be studied and restudied. It may be improved and improved again. So the very personal intelligence which makes mistakes can rectify them. Waste may be succeeded by genuine efficiency. The whole story is the tale of personal intelligence observing, experimenting, thinking, working, and finding its way.

V

James O'Donnell Bennett, writing of Johann David Wyss' *Swiss Family Robinson* says: "A sensible boy, having attentively read the story, has learned more about processes, contrivances and the nature of things, animate and inanimate, than most adults who have not read 'The Swiss Family Robinson' ever learn." He goes on: "It is an epoch in little of civilization—a romance of the varied contrivings by which man has raised himself from the state of nomad to the state of developer, controller, and —more or less—of perfecter." It is a tremendous tale, whether you read it in the large in the tale of the practical application of facts and principles or in a thoughtful tale like that written by the venerable Swiss pastor. And the tale always has one hero—the patient, ingenious, contriving mind of man.

Let us take a look at the aspects of this adventure seen in deliberate selection and cross-pollenization in respect of plants. Here a very concrete hero is within our reach in the person of Mr. Luther Burbank. When you watch him changing the size, the form and the color of a flower by means of a few generations of breeding, guided by his selective hand, you seem to see a veritable wizard at work. You watch him taking the pollen from flower to flower by hand. And then you see the miracles begin to happen. But the miracle, of course, is in the application of observing intelligence to the ways of plants. So he has produced—almost at specification —peas which are ready to produce ten crops in a season, peas which are smooth, peas which are wrinkled.

Inez N. McFee paints a picture of Mr. Burbank at work: "On a certain day, Burbank's quick eye noted a slight gradation in a single petal of the common, orange-colored, wild poppy. It was only a thin line of crimson running up the center, but to this plant wizard it spoke volumes. The seed of the new plant was carefully planted. Then the blossoms were eagerly awaited, and as he expected, one plant had petals with a crimson line, slightly wider and more colorful than the first one. The next generation showed further progress toward the crimson hue; eventually selective breeding produced a poppy whose petals were crimson throughout. This is the poppy known to botanists as Eschscholtzia. In the experiment were produced single poppies and double poppies and poppies of many ruffles; then a Shirley poppy appeared with a hint of smokiness in its red beauty. 'Good,' said Mr. Burbank, for all along he had desired to produce something that no one had yet seen—a blue poppy; and his sense of color told him that this was at hand. Selective breeding accentuated the smokiness until shortly a blue tint was patent to all, and finally the blue poppy was born,—a flower that seems a marvellous transformation and yet its production was simple enough." [3] The tale of Burbank's achievements reads like the story of a visit to some magic island. In three generations he so dealt with the calla lily that he gave it an exquisite perfume. Leaves and stalk have changed at his command. The cactus has lost its spine and having cast off its prickles is all ready to be food for cattle. He is ready to be stern and unhesitating in his methods. Thousands of bulbs are destroyed. Only the few having their strange seed of promise are conserved.

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[3] Inez N. McFee, *The Wonderful Story of Science* (Crowell), p. 144.

As you watch the work of cross-pollenization and selective breeding you must think of the flowers and their mysterious processes. But you must not forget Mr. Burbank. He has changed the face of nature for a good many people by his infinitely careful observation and his clear thinking and his unhesitating experiment. The Shasta daisy would never have existed without the work of Mr. Burbank. And the Shasta daisy is a product bearing silent testimony to what can happen when human intelligence begins to deal with the life processes of flowers. Nature is really vastly responsive to intelligent treatment. Do you want new colors? Very well, here they are. Do you want new forms? They come at your command. Do you want fragrance where there seemed no possibility of such a consummation? Do a little patient work and your labor is rewarded and your desire is gratified. When we have entered the biological field somehow the results seem even more startling than when we were dealing with the processes represented by the science of physics. It is now as if the great mother has begun to share her secrets with us.

One of the oddest results of such bewildering achievement is seen when a certain type of thinker becomes so engrossed in the process that he forgets the intelligence which produces its extraordinary results and actually finds it harder to believe in intelligence because he has seen intelligence at work. The philosophical significance of Mr. Burbank is really quite overwhelming. Upon that we must keep our eyes fixed. And we must not allow ourselves to forget what is really the point of most definite importance. That we live in a world which responds to Mr. Burbank's experiments is remarkable indeed. But that Mr. Burbank is here to perform the experiments is a matter which opens a door upon our understanding of the realities involved in experience. If you are tempted to believe only in mechanical and impersonal processes "page" Mr. Burbank. Follow that curious, penetrating, puzzling, dreaming mind of his to its lairs of thought. He comes back ready for another experiment. So he controls the processes of biology itself. And the whole process is just another example of personality in action. The knowing, thinking, experimenting mind carries the great secret about with it.

VI

In 1892 Louis Pasteur reached his seventieth birthday. On that day it may well have seemed that the whole civilized world joined to do him honor at a meeting held in the great theater of the Sorbonne.

The President of France escorted Pasteur down the aisle. That great composer Gounod directed the choir which sang his "Ave Maria." The poet Coquelin recited his own tribute written for the occasion. Delegates from scientific societies and public bodies from all about the world united in glad acclaim to do Pasteur honor.

What had this man of seventy years done that he so found the world at his feet? When the curtain rises on the boy of sixteen he does not cut a very heroic figure. He is at the École Normale in Paris and he is so homesick that he longs for the odor of the old tannery—his father and grandfather and great-grandfather had been tanners—and his father has to take him home to Arbois. Here he studies faithfully for two years. Then there are two years at Besançon and then at twenty he is ready to make the most of the opportunities of the École Normale in Paris. By 1849 he is professor of chemistry at Strasbourg. By 1854 he is professor at Lille. Here his studies of fermentation save the wine industries of France. And more important than that, he begins to strike blows at the idea of spontaneous generation and to understand the tiny creature whose multiplying life expresses itself in fermentation. Once let these matters be understood and no end of doors begin to fly open.

Men in Southern France are having trouble with their silkworms. They appeal to Pasteur. Now he begins to study bacteria in a new fashion. The crisis is so great that when the workers meet each other they say: "Good morning, how are the silkworms this morning?" So Pasteur sets to work. He finds what he calls corpuscles in some of the eggs. He thinks he has found the disease. He finds a bacterium which does its share of the mischief. And now he works out methods of protection by which the silk industry of France is saved. And again the principles involved are more important than the specific achievement.

Cattle and sheep are suffering from a dreadful disease, *anthrax*. When it attacks a human being it is practically sure to be fatal. Pasteur now attacks this problem. Jenner back in 1798 had discovered the possibility of vaccination in respect of smallpox. What if a similar treatment could be worked out for anthrax? Before this time Pasteur had discovered a process of vaccinating poultry to prevent cholera. Now he sets about the study of the anthrax germs. Such experiments are long and they require endless patience and insight and creative thought. In this study Pasteur fell upon the idea of progressive vaccination. At last he was sure that the secret was his. Then at Mileur in France the great and dramatic public demonstration was carried out. Twenty-five sheep and six cows were vaccinated. Twenty-three sheep, two goats and four cows were left free from vaccination. The principle of progressive vaccination was used. And at length the virulent germs were given to all the animals. Men had come to applaud. Other men had come to mock. But the experiment proved to be a triumphant success. When the delegates beheld every one of the sheep and cows and goats which had not been vaccinated, dead or dying or seemingly ill and saw that not one of the vaccinated animals died, those who had come to scoff remained to praise. Now men knew how to deal with anthrax.

By 1868 Pasteur was partly paralyzed. And now he turned his attention more directly to that dreadful disease, the hydrophobia which indeed he had been studying for years. At last he found a desiccated nerve tissue which gave a rabbit a mild attack from which it recovered. And so gradually he was able so to inoculate a rabbit that a later bite of a creature suffering from hydrophobia was innocuous. Now suddenly Frau Meistir of Alsace appeared with her son Joseph who two days before had been bitten fourteen times by a rabid dog. What was Pasteur to do? The treatment had never yet been given to a human being. Without it the lad's death was practically certain. The mother and the boy had touching faith in Pasteur. He decided to see what he could do. Between treatments the lad and his mother slept in simple faith. But Pasteur himself scarcely slept at all until it was seen that the treatment was successful and the boy's life was saved.

Nineteen men in fur caps came to Paris. They were Russian peasants from Smolensk. They had been bitten by a mad wolf. They did not know much French. But they could say "Pasteur" and though the poison had been at work for two days he was willing to try to save them. Three of them died. Sixteen were saved by the treatment. The Czar of Russia was so impressed that by the hand of the Grand Duke Vladimir he sent the diamond cross of the Order of St. Anne of Russia to Pasteur, and accompanied that gift by a large sum of money to be used in connection with building the Pasteur Institute.

This is at least a part of the story of the achievement which received such glittering recognition in the great theater of the Sorbonne on Pasteur's seventieth birthday. Here we have a scientist invading the world of disease and death, making a study of those deadly processes which deplete the vitality of creatures like silkworms, of useful domestic animals, and even of men. He thinks constantly. He experiments ceaselessly and without hesitation. And once and again triumph sits upon his banners. From the outside it looks like magic. From within you see that it is the effort of the shrewd and observing and classifying and projecting and creative mind. It is another triumph of that personality whose controls are more and more being felt in all sorts of physical and biological relationships. Here again it is important that we keep our eyes fixed upon the personal achievement. When we hear Pasteur say "La vie c'est le germe et le germe c'est la vie," we are quite likely to be so interested in the germ that we forget Pasteur. But we must not forget him. And the remembering must consist of something more profound and more critical than just grateful recognition of his services to humanity. It must involve a close and painstaking analysis of those qualities of mind which made his work possible. Only a mind which transcended the uniformities with which he dealt could do the work which he was able to do. And that curious, exploring, daring mentality is really at the heart of the whole matter.

VII

One of the most distinguished names in the entire history of surgery is that of Joseph Lister. This English Quaker spent a part of his professional life in Edinburgh and Glasgow and passed its final period in London. Ample recognition of every sort came to him though he had many a difficult experience with colleagues of his own who did not understand the significance of the man or his work. In 1883 he was made a baronet. And in 1897 he was elevated to the peerage and became Lord Lister. Dr. S. Weir Mitchell wrote to him that he certainly never expected to address a physician as a peer of the realm.

The situation in respect of surgery, even up to a fairly recent period, represents conditions extremely crude and indeed menacing. Sir James Simpson collected statistics of more than two thousand amputations in hospitals and more than two thousand in country practice. "His analysis seemed to prove that the mortality was larger in hospitals than in private houses and that it increased exactly in proportion to the size of the hospitals. He asserted that 'the man laid on the operating table in one of our surgical hospitals is exposed to more chances of death than the English soldier on the field of Waterloo.'"[4]

This was, of course, the old day. We quote a telling and vivid description of the situation: "Before the introduction of antiseptics by Lister, the surgical wards of hospitals in the middle of the last century were usually crowded and often poorly ventilated. The nursing was in the hands of ignorant and often rough women, since nursing was not undertaken by women of education and refinement until a training school for nurses was founded by Florence Nightingale at St. Thomas' Hospital in London in 1860. The surgeons and dressers upon entering the wards removed their coats and donned some old and soiled one, respected for its years of service. In the button-holes of these coats were usually several silk threads or ligatures ready to the hand, after an application of beeswax, whenever a stitch was needed. One or two jugs of water were ready in which to rinse the instruments or marine sponges as the surgeon went from bed to bed doing his dressings. Naturally under these conditions no wounds were clean, and pus formation was so universal that it was considered a necessary part of the healing process." [5]

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[4] Murray, *Science and Scientists in the Nineteenth Century,* p. 266.

Lister had been much impressed by the difference in respect of healing in the case of simple and compound fractures. In the simple fractures the skin was unbroken. In the compound fractures the skin was torn apart. In the one case the healing was quite without characteristic hospital disease though the crushing of the bone within might represent an ugly case. It seemed clear that something getting into the wound from the outside made the great trouble. Lister turned his attention to the work of Pasteur in connection with bacteria. Like the coming of a flash of light was the recognition of its connection with his own problem. Out of the air and from malignant developments in other patients came the bacteria which produced all sorts of tragic developments. How could it be prevented? If the air could be sterilized, if the wound could be sterilized, if the surgical instruments could be sterilized, if the hands of the operating surgeon could be sterilized—what might not come of that? Freedom from infection was the goal, and right rapidly Joseph Lister moved toward it. The use of carbolic acid was found to be particularly effective. By close observation, by careful experiment, by clear and unhesitating processes of thought Joseph Lister worked on day after day, month after month, and year after year, until antiseptic surgery won a complete and overwhelming victory. When one thinks of the lives which have been saved and of the suffering which has been prevented by antiseptic surgery and by the surgical methods which have grown out of it, the service of Joseph Lister to mankind begins to appear in its true proportions. And here again the free moving mind of the investigator is the important matter. It has been observed that Pasteur's work lay before the eyes of the surgeons of France but it was a worker in Scotland who saw its meaning. Pasteur himself had said: "In the field of observation chance only favors the mind which is prepared." And that mental preparation which consists of the constant use of the observing mind and the play of free and creative thought about it was precisely that which Lister brought to his work. Once more personality was responsible for the resources and the activities which made great achievement possible.

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[5] **Lambert and Goodwin, *Medical Leaders*, p. 277.**

VIII

In the year 1922, during the summer, nineteen men united to present a course of lectures in Teachers College, Columbia University. The purpose of the course was to present some of the achievements of modern science in a way which would be both vivid and accurate. The material was published in a volume entitled *Science Remaking the World,* edited by Otis W. Caldwell and Edwin E. Slosson. A particularly significant and fascinating chapter was contributed by Dr. Slosson under the title "The Influence of Coal Tar on Civilization." He had already told a good deal of this story in his dramatic fashion in that delightful volume *Creative Chemistry*. We want to make some reference to the almost startling story of the by-products of coal tar before concluding this subject. Coal tar seems a most unpromising material. It is "black, smelly, sticky stuff, neither liquid nor solid but variably between, depending on the temperature, hard to handle because it could be neither poured like oil nor picked up like coal, combustible but not convenient for fuel, poisonous to fish if run into the water and offensive to folks if left on the land. It was worse than a waste product: it was a nuisance. It clogged up the gas works in the old days and could hardly be given away. When the chemist took this disagreeable stuff in hand he extracted from it, or rather prepared out of it useful and beautiful things innumerable. Out of the strong came forth sweetness. The most dainty perfumes, the most brilliant colors, the most potent drugs, the most violent explosives, the means of destroying life and extending life and making life more enjoyable."[6]

In the year 1856 William Henry Perkin was working after hours in a private laboratory he had set up in London. He was trying to prepare artificial quinine from coal tar. And here quite by accident he came upon *mauve,* the first of the aniline dyes to be discovered. England did not realize the significance of the discovery. It was the Germans who really developed it and by 1914 we hear of 925 coal tar dyes used in trade. There are no end more which the chemist can make if he so desires. These dyes have brought a new reign of colors to the modern world. They have brought color for food and color for clothing. And they have made color democratic.

But coal tar is accountable for wonderful odors as well as for lovely colors. The chemist has become a great rival of the flowers in this matter. And once and again he does better than the flowers can do. The perfumer has learned that often the chemist can do for him what no one else can do.

But coal tar has only begun to reveal its secrets when we think of lovely colors and fine odors. It is a mother of explosives. Tuoline used in war time for making what was often called TNT was a by-product of the coke oven. America tried to make the best of this knowledge and by 1918 the coke owners of the country were able to produce 12,000,000 pounds of tuoline in a month. The Germans, of course, knew more about the explosives of which coal tar held the secret, than anyone else. And as a matter of fact, coal-tar products almost lost the war as far as the Allies were concerned.

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[6] Caldwell and Slosson, *Science Remaking the World,* p. 69.

Coal tar is also a mother of drugs. Salicylic acid is good for corns and for rheumatism. Carbolic acid can be made directly from coal tar. Coal-tar products such as aspirin have fought headaches all over the world. Coal-tar products have produced local anæsthetics. Thymol, by which hookworms may be expelled, is a benzene compound.

Dr. Robert Koch used aniline dyes to stain microscopic disease germs and to take their pictures on a photographic plate and a new day of discovery and achievement dawned. The bacillus of tuberculosis, the bacillus of Asiatic cholera and the bacillus of typhoid fever were discovered. Then a serum to prevent typhoid fever was developed.

Coal-tar products through fertilizing properties may be used to make the desert blossom as the rose.

And so we might go on and on and on.

At the heart of all the vast and varied and romantic tale of coal tar is the curious, observing, experimenting, patient, creative, projecting mind of the scientist. Without his free and active mind coal tar is just coal tar and nothing more.

IX

So at the place of control stands a man. He has the disciplined knowledge and the technique of the scientist. He is an explorer whose mind goes everywhere. And with relentless skill he bends the forces of nature to do his will. Facts are his soldiers and they march forth at his command. Forces are his officers and they direct his vast armies to do his bidding. Through many centuries the facts have been waiting. Through millenniums the forces have been ready to obey when they heard the master's voice. Then this amazing phenomenon of the observing, analyzing, classifying, commanding mind begins to do its work, and nature has found a master indeed. All the facts waited for the personal intelligence which would discover them. All the processes waited for the personal intelligence which would bend them to its own purposes.

And the end is not yet. Personal intelligence stands confronting unmastered mysteries, uncontrolled forces, and proudly enters upon regions where undiscovered facts wait to yield up their secrets.

We see then with indubitable certainty how fundamental is personality in all the processes connected with science. All the vast and varied organization of knowledge which bears the manifold names of the physical and the biological sciences is an age-long achievement of personality. All the varied and startling achievements in the control of the world which science has made known are the work of personality. Free, critical, creative intelligence holds the key to the mysteries. It does more than hold the key. It makes the key. It puts it into the lock. The key turns. The door opens. And upon ever new vistas the adventurous mind of man looks out. If you think with genuine insight you will never become so engrossed with the vast body of science that you forget the scientist. His scintillating, darting, daring intelligence is the most important matter in the whole story. Really it is a tale of personality first, and last, and all the way between. For the theoretical and the practical sciences simply lift the curtain and allow us to look upon personality in action.

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CHAPTER III

THE ETHICAL CONTROL OF THE MATERIALS OF CONDUCT

"OURS is a lost cause and there is no place for us in the natural universe,"[1] declares Mr. Joseph Wood Krutch at the conclusion of that naked and terrible book *The Modern Temper.* He has weighed the universe in the balances and found it wanting. He has weighed this planet in the balances and found it wanting. He has weighed humanity and science and law and art in the balances and found them wanting. He can find no secure basis for moral sanctions. He can find no solid foundation for any noble idealism. If you ask him "Is science the friend of the ethical life?" he is ready to reply with an unhesitating "No." If you ask him "Is science the foe of the ethical life?" he is ready with an unhesitating "Yes." With quiet dignity and a power which has its own grim austerity, he explains in page after page the fashion in which the world to which our minds have brought us in this age of science is a world with no place for the gracious beauty of human love, no place for the sure trust in a living

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[1] Page 249 (Harcourt, Brace & Co.).

God, no place for the belief in a stainless beauty, no place for the greatness of responsibility or the grandeur of hope. We cannot give up the quest for knowledge, and yet the more we know the more intolerable the world becomes. We cannot give up the laboratory, yet the pursuit of its investigation leads to the death of our most gracious hopes. The triumph of the mind is the stultification of the conscience, the crushing of the heart and the death of the sense of beauty. We find ourselves homeless in a world whose essential quality involves the contradiction of all our highest beliefs, the death of our most gracious hopes, the annihilation of all that gives life meaning or value. We cannot part with our intellectual candor. Yet that candor poisons every experience for which we really care. The mind is a wild beast we must hold to our bosoms while it eats out our hearts. If we understand its meaning, science gives us a great body of unwelcome knowledge and leaves us grim and hopeless pessimists in a darkened world.

I

Whatever else we say of books like this powerful outburst of Joseph Wood Krutch, we must say that they have a deep and far-reaching significance. We may give the book a nickname and call it *The Modern Distemper*. In that case the disease whose progress it follows just because it is a cancer eating into the contemporary mind, deserves the most searching diagnosis.[2] For here is no voice crying in the wilderness in the name of a vanished creed. Here is no belated follower of Mr. Bryan greatly desiring to turn the world into a vast Tennessee. Rather here is the voice of a new generation which has confronted a mechanistic interpretation of the universe and has made the great acceptance. Mr. Krutch has very definitely said farewell to God. He has watched the moral sanctions pass out of sight beyond the far edges of the world. He has seen sex become a thing of sheer beastliness and beauty an odd titillation of the nerves. He has been ruthless with a kind of austere joy in his own intellectual integrity. And he stands dauntless amid the ruins of everything which he finds it possible really to prize. He is not entirely without consciousness of the magnificence of representing the last flutter of morality in an immoral world. But he smiles in grim sarcasm at the futility even of that last regal gesture of defiance in an unfriendly universe.

At once one can say that there is about Mr. Krutch's work at least the virtue of a candor which faces without hesitation the whole logic of his position. Mr. Bertrand Russell has a jolly way of laying a foundation of despair and then building an astonishing edifice upon it. There is the swift flash of his wand, and quite forgetting the consistency which his great achievement in mathematics would seem to assure, he suddenly turns evangelist and cries out with eager summons in the name of assumptions which he has already declared to have no validity. It is all so dazzling that we are quite likely to miss the flaw which robs it of any sort of mental or moral authenticity. But Mr. Krutch will have no such futile and romantic and compromising inconsistency. He looks his principles squarely in the eye. He calls them by their right names. And with amazing candor he goes the full length of their logic. Such grim honesty is a powerful rebuke to the tender-minded intellectual diplomats who would like to accept a mechanistic view of life and retain all the mental comforts of living in a personal world. The new generation may have tragic faults. But it has a splendid way of brushing convenient and comfortable evasions aside and speaking the whole truth as it sees the truth. For this we may be heartily grateful to Mr. Krutch and to those to whose thoughts he has given a voice.

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[2] Professor Millikan who is always so delightfully on the side of the angels has recently replied to a mild and almost friendly discussion of the menace science may be to the modern world. One would like to see him deal in great detail with the really serious writing of Mr. Krutch.

II

The general situation reflected by Mr. Krutch's book has received various treatment as it has been dealt with by various minds. Mr. C. E. Ayres, for instance, who often writes with his tongue in his cheek, and always with corrosive and potent irony, has produced a volume entitled *Science the False Messiah*. He has constructed a blasphemous and ironic paraphrase of the Apostles' Creed which reads:

"I believe in atoms, molecules and electrons, matter of heaven and earth, and electrical energy its only form. I believe in Modern Science, conceived by Copernicus, borne out by Newton, which suffered under the inquisition, was persecuted and anathematized, but rose to the right hand of civilization as a consequence of the fact that it rules the quick and the dead. I believe in the National Research Council, the communion of scientists, the publication of discoveries, the control of nature and progress everlasting. Amen."[3]

Mr. Ayres is ready to declare that science itself has become a superstition great and constantly potent though in another guise from the superstitions from which we believe we have escaped. He calls science a new folk lore. He tells us constantly that after all the facts are just what they are. There are plenty of facts which do not fit the theories of which we hear so much. And these uncomfortable facts are kept in the background until new theories are constructed into which they fit. As a matter of fact, science can only deal accurately with material capable of quantitative measurement. Mr. Ayres fears machines and their kingdom and he feels that they are the gift of that fairy godmother science to the world. He feels a kinship with Samuel Butler who long ago in *Erewhon* so savagely attacked the machines. The new freedom really means the dissolution of a whole civilization—without another in sight—and the repudiation of the entire past. Science can give us abstractions. But is any abstraction an adequate substitute for God? Mr. Ayres suggests a series of theses to be nailed to the laboratory doors. He declares that "scientific formulas however charmingly mysterious they may be, do not touch the central problems of living." He observes that "the credit of science rests wholly upon its connections with machine technology, of which it is a part." With caustic energy he insists "that by trying to make our beliefs scientific we have only succeeded in making them absurd." He reminds us that "the laws of science are not statutes; they are definitions." He insists that "when science has become supreme any attempt to rectify its formulas will be persecuted as heresy."[4]

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[3] C. E. Ayres, *Science the False Messiah* (Bobbs-Merrill), p. 129.

Here you have an adventurous and cynically critical mind appraising the various claims which have been made for science, and the intellectual atmosphere which certain types of scientific interpretation have created in the world. That Mr. Ayres sometimes explodes paradoxes in order to be sure of gaining attention is clear enough. That having seen one set of extremes he has a kind of cool joy in seeing what can be done on occasion with another set of extremes, is hardly to be denied. But that once and again one of his sentences, piercing like a sword, cuts to the heart of a contemporary fallacy is equally evident to the reader who comes to the book equipped with critical intelligence. *Science the False Messiah* is not a judge's charge to the jury. But it is a very significant utterance for all that. And one of the clearly established results of this brilliant examination of far-flung materials is just a sharper insight into the fact that an enormous amount of popular discussion based upon supposedly scientific principles has made for no end of ethical confusion.

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[4] *Ibid.*, pp. 294-296.

III

Dr. Horace Bridges since 1913 has been the leader of the Chicago Ethical Culture Society. In 1928 he published a volume of arresting and penetrating thinking, entitled *Taking the Name of Science in Vain*. Dr. Bridges is one of those clear and radical (in a good sense) thinkers who dare to call their souls their own in the presence of the most arrogant and self-assured and dominant movements of thought. He looks out upon the vast restless world of modern discontent. He believes that he has isolated and identified the bacillus which has produced the disease. "The hidden canker," he says, "is the depreciated estimate of the worth of life itself, of the dignity of man, which has spread with the spread of science, and with those misconceptions of the meaning of scientific truth that the inexpert public has unawares imbibed."[5] Dr. Bridges fixes his attention particularly upon certain mechanistic interpretations of life and the universe which claim the authority of modern science. "Man is a machine which without consciousness, thought or mental life, invents and controls other machines. It is a beautiful simplification,—provided we permit our theorist to re-introduce surreptitiously under the guise of mechanistic terms all the meaning which he has labored to evaporate out of the natural language of personality."[6]

Thinking particularly of Behaviorism as set forth by Dr. John B. Watson, Dr. Bridges asks the penetrating and devastating question: "If Behaviorism were true how could we know it?" The very principles of Behaviorism would prevent knowledge of any kind if these principles exhausted the reality of the universe. You must be outside and above such a system in order to become conscious of it. There is this fatal flaw in all deterministic thinking: its advocate asserts that he and the rest of humanity are the mechanical products of a deterministic world. Yet he "can shift the gears and manipulate the levers so as to subject other people to stimuli which would never occur but for his prescient and planning mind."[7] It is odd to find the determinist actually expecting us to trust the validity of his argument to prove that reason cannot be trusted. Dr. Bridges' headlong yet carefully calculated attack on mechanistic interpreters of science can be summed up in his own words: "Man for them, as we have seen, is 'an assembled organic machine, ready to run.' Well, if they intend this seriously, they are under obligation to furnish us with a rationale of the rights of mechanism. Either they must show why we should be kind and gentle to the clock and tender and merciful to the locomotive, and why we should mete out impartial justice to the automobile and the pile-driver, or they must give up all pretence that man possesses any rights so inalienable that no amount of power can justify any person or number of persons in disregarding them or setting them at naught. If man is a mechanism, either all other machines must acquire rights or man can have none."[8]

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[5] Horace James Bridges, *Taking the Name of Science in Vain* (Macmillan), p. 18.

[6] *Ibid.*, p. 38.

Here again we have a mind of brilliant critical powers fearlessly analyzing the results which would inevitably follow from the acceptance of certain in-

[7] *Ibid.,* p. 57.

[8] *Ibid.,* p. 222.

terpretations of the data furnished by the physical and biological sciences. The contradictions inherent in these interpretations are brought before us in words not without a certain corrosive power. Dr. Bridges is very clear that the principles which would remove the foundation of ethics would also uproot every growth of intelligence. He is as honest as Mr. Krutch but he has a much firmer grasp of the elements of the problem. He can be as acidly brilliant as Mr. Ayres but he has a much wider and surer command of the relationships of the difficult materials with which he has to deal.

IV

"Whirl is King, having driven out Zeus," Mr. Walter Lippmann quotes from Aristophanes at the beginning of the section on "The Dissolution of the Ancestral Order" in his forceful and arresting book *A Preface to Morals*. Ever since the publication of *Drift and Mastery* in 1914 and the hearty recognition of Mr. Lippmann's powers by Colonel Roosevelt, thoughtful readers have been following his writing with unusual interest. As associate editor of the *New Republic* and as a member of the staff of the New York *World* he has made himself widely felt. He has all the restless intellectual powers which so often characterize the brilliant Jew. And he has never escaped from the recurring sense of distinctions which must have been made clear to him when he felt the power of the mind of Professor Irving Babbitt at Harvard University. *A Preface to Morals* opens with a very frank diagnosis of what Matthew Arnold called "this strange disease of modern life." It is very clear to Mr. Lippmann that the passionate rebels of the days just behind us did not think thoroughly. "We know now that they did not see very clearly beyond the evils against which they were rebelling."[9] We now understand that Huxley was right when he declared that "a man's worst difficulties begin when he is able to do as he likes." As a matter of fact, it is now necessary to admit that "we have succeeded only in substituting trivial illusions for majestic faiths."[10] "The modern man—has ceased to believe without ceasing to be credulous."[11] The pressure of the whole situation is so intense that our time has produced a type of thinker to whom rebellion itself is the object of disillusionment. The life of the modern man "seems mere restlessness and compulsion, rather than conduct lighted by luminous beliefs."[12] Such a man seems to Mr. Lippmann to be like the confused person of whom Mr. Santayana said that he redoubled his effort when he had forgotten his aim. All this and more is the result of the application of the acid tests of modernity to old sanctions and old beliefs.

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[9] *A Preface to Morals* (Macmillan), p. 6.

[10] *Ibid.*, p. 8.

[11] *Ibid.*, p. 9.

[12] *Ibid.*, p. 19.

Authority has really quite broken down. Life is like a great world empire which has been losing one mighty province after another. Desires are insistent. Standards have vanished. "Morality thus becomes a traffic code designed to keep as many desires as possible moving together without too many violent collisions." [13] So Mr. Lippmann writes amid the breakdown of sanctions and the disintegration of moral and religious worlds.

V

So we see that many voices reflect the modern confusion. These thinkers occupy different positions and have different interests. But the reader has no difficulty in discovering that they are talking about the same situation. They have a common background. They are threatened by one overwhelming tragedy. Some have surrendered. Some are defiant. Some are trying to erect edifices which will withstand the avalanche. All feel the cold of an approaching age of ice. The great glaciers are moving southward and it is increasingly difficult for vegetation to thrive. The world to which the physical and biological sciences have introduced us is the world of this tragedy. Mr. Krutch would say that inevitably it must be so. Mr. Ayres begins to suspect that claims have been made for science as a philosophy which science cannot authenticate. Dr. Bridges is ready to assert that the name of science has been used to give authority to positions with which science has no inherent or necessary connection. Mr. Lippmann is inclined to accept the world contemporary scientific thought offers, and yet to refuse to go upon such a road of pessimism as that in which Mr. Krutch travels. He would build a house—some of us would call it a halfway house—in which moral values may be retained in company with all our changed views of the meaning of the experience and the nature of the world. He has created a brand of humanism all his own for the conservation of moral values.

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[13] *Ibid.*, p. 114.

These voices to which we have been listening are more than individual voices. They are typical of attitudes to be found wherever contemporary men attempt to confront the dark and baffling problems of life.

The men of the halfway house have an interest of their own. Professor Irwin Edman is one of them. He has written a kind of Pilgrim's Progress of the new generation in his fascinating volume *Richard Kane Looks at Life*. The haunting question back of all the arresting tale of Richard Kane's experience is this: Can the gracious and lovely values in which the rarest spirits of the world have believed survive their contact with the hard facts which have become the possession of the contemporary mind? Richard

Kane has many a keen tussle. But on the whole he is for the great values. And so, obviously, is Professor Edman. The joy of the iconoclast has been outgrown. We are in the presence of minds seeking to find those richer elements of experience which a mechanistic conception of the universe seemed so entirely to deny. This position is set forth with persuasiveness and gracious charm in Professor Edman's book with the astonishing title *Adam, the Baby and the Man from Mars*. It is all very delightful. And in one way it is all very heartening. But the critical thinker will scarcely fail to see that neither Richard Kane nor his creator has managed to get into a universe which justifies their nobler beliefs. The facts and the values are still in a state of clenched antagonism. A narcotic has been applied to the facts. And so the values have great and joyous freedom. But one keeps asking what will happen when the facts emerge from the effects of the narcotics which an eager idealism has applied to them. In the long run must not Professor Irwin Edman believe more or less? Must he not reduce his values to the dimensions of his world of facts? Or, on the other hand, must he not find a method of interpreting his facts which makes room for his values?

The same thing must be said of Mr. Lippmann's attempt at constructive ethical thinking in *A Preface to Morals*. As a matter of fact, his humanism—and many authorities would hesitate before granting his right to that old and gracious word—is "human all too human." There is much clear and wise and effective thinking on certain levels. But he never succeeds in getting into a universe which will justify the sanctions about which he cares so deeply and so nobly. In the long run Mr. Lippmann will find that his halfway house is uninhabitable. He must go backward. Or he must go forward. He must believe more. Or he must believe less. He must live in a universe which justifies his ethical code. If he does not, that code will become impossible.

It is good to see Professor Irwin Edman and Mr. Walter Lippmann begin the journey away from the land of negatives. One watches their advance with fascinated interest. And one breathes very sharply and tensely as one sees how precarious is their position on the cliffs of the mountains which stand at the Great Divide.

VI

It is quite evident that we must come to close grips with this whole subject of a mechanistic universe as a by-product of scientific study. For my own part I see no good in denying that a completely materialistic and mechanistic universe would be one in which there would be no room for a genuinely moral life. In such a universe ethics simply could not survive. At this point I quite agree with Mr. Krutch. Of course, in such a universe it would be difficult to account for the presence and the pessimism of Mr. Krutch himself. Of this more later. In the meantime let us frankly admit that if the universe is just a machine and nothing more, there is no place for moral ideals, for moral sanctions, for moral responsibility in it.

Mr. William Cecil Dampier-Whetham in his *History of Science and its Relations with Philosophy and Religion*, recently published by the Cambridge University Press,—perhaps the most competent history of science which has been published in the English language,—describes the situation in England when Sir Isaac Newton had worked out the formulas which expressed the law of gravitation. Newton thought that his music of the spheres sang of an all-wise and all-powerful God and in his modesty likened himself to a child finding pretty pebbles on the shore while the ocean of truth lay unbroken before him. . . . Newton's countrymen in general retained not only Newton's science but Newton's philosophy and the essence of Newton's faith. This English tendency to hold simultaneously to beliefs which in the knowledge of the time, seem incompatible, is a constant surprise to continental minds. It probably arises from an instinctive apprehension among a political people that there is usually much to be said for both sides of a question and that further knowledge may reconcile the seeming incompatibilities. In abler minds it discloses a truly scientific power of following two lines of useful thought, while suspending judgment on their deeper implications and correlations for the examination of which there is not yet evidence available.[14]

On the continent, however, men followed the logic of the position to the bitter end. The men in France who followed Newton felt that the logic of his position inevitably reduced reality to a mighty machine. Man with every part of his organism and every aspect of his activity was thus caught up in a rigid mechanical necessity. Mechanical determinism was set forth by such a writer as de la Mettrie who in his book *L'Homme Machine* frankly attacked the theistic position and Christian morality as well.

So the stage is set and year after year and decade after decade the battle between mechanistic materialism and a view of the universe which makes room for free mental decision and free moral action goes noisily if not merrily on. Dr. John Watson's type of Behaviorism is in direct and unapostolic succession from the French mechanists who made the formulas of Newton the basis for positions which he himself would have unhesitatingly repudiated.

Mr. Dampier-Whetham says frankly that materialism as an attempt to explain consciousness is an obvious failure. He is sure that it cannot survive the destructive analysis of any really critical philosophy.

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[14] Dampier-Whetham, *A History of Science,* p. 214.

Professor Alfred North Whitehead in his Lowell Lectures on Science and the Modern World subjects the materialistic position as a corollary of science, to close and critical analysis. He says: "If we confine ourselves to certain types of facts, abstracted from the complete circumstances in which they occur, the materialistic assumption expresses these facts to perfection. But when we pass beyond the abstraction, either by more subtle employment of our senses, or by the request for meanings and for coherence of thoughts, the scheme breaks down at once." [15] Speaking of the theory of materialistic mechanism, he says that its difficulties soon become apparent. "The history of thought in the eighteenth and nineteenth centuries is governed by the fact that the world had got hold of a general idea which it could neither live with nor live without." [16] Speaking of the "arbitrary laws of nature determining locomotion," Dr. Whitehead says: "They were empirically observed but for some obscure reason were known to be universal. Anyone who in practice or theory disregarded them was denounced with unsparing vigor. This position on the part of scientists was pure bluff, if one may credit them with believing their own statements."[17] Without hesitation in summing up his historical review of the impact of science upon thought, Professor Whitehead says: "In this retrospect I have kept in mind that the ultimate issue of the whole story is the potent dissolution of the comfortable scheme of scientific materialism which has dominated the three centuries under review."[18] Here then quite obviously is another side of the whole tale. Both Mr. Dampier-Whetham and Professor Whitehead see clearly enough that a mechanistic materialism would be the end of ethics and of no end of other important things. But they also see that it has no honest standing in the intellectual world as a complete view of the universe. At a touch of really critical attack it collapses like the last giant fought by Gareth in Tennyson's poem "Gareth and Lynette." This mechanistic philosophy is not science. It is pseudo-science. The critical scientist knows that reality has mechanical aspects, but he does not reduce reality itself to mechanism. He knows that this would be the death not only of morals but of science itself.

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[15] Whitehead, *Science and the Modern World* (Macmillan), p. 26.
[16] *Ibid.*, p. 74.

VII

And now we are ready to take a preliminary view of the relation of the scientist of critical mind to these important matters. First of all he realizes the meaning of the thesis which lay at the center of everything said in the discussion of Science as an Achievement of Personality. Science itself, from its dim beginnings to its present colossal activities, is the achievement of free moving critical intelligence. The scientist must transcend the physical uniformities in order to discover them. He must transcend the mechanical aspects of existence in order to reduce them to a series of formulas. Only in a universe where freedom and mechanism meet can the mechanical aspects of experience be analyzed and catalogued and understood. In the presence of the fact of the scientist all mechanical materialisms which claim to cover the whole realm of reality go down with a crash. The critical scientist may consent to a good many things. But he cannot consent to commit intellectual suicide. He cannot accept a view of the universe which would make his own activities impossible.

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[17] *Ibid.,* p. 277.

[18] *Ibid.,* p. 226.

Then the critical scientist sees with entire clarity that the control of all the forces which science has revealed requires just that free moving intelligence which we followed through manifold activities in the discussion of the Personal Control of the World Which Science Has Made Known. And here again he comes upon features which quite transcend mechanistic materialism. The inventor cannot be crushed into any space which a deterministic view of reality offers him. And when it comes to his invention, it is clear enough that he must transcend the mechanical in order to make machines. He must transcend the mechanical also in order to use them. You cannot get the driver of an automobile or the pilot of an aeroplane into a completely mechanical universe. They master and use mechanical uniformities. They are their rulers and not their slaves.

The critical scientist, then, is thoroughly aware that the whole history of science and the history of the practical application of the principles of science is a wholly adequate answer to the assertions of those who advance the claims of mechanistic materialism. Indeed, the advocates of these claims are in the most astonishing position. They are calling in logic to make secure positions which would make impossible the existence of the logical faculty itself.

And on this broad and firm basis the critical scientist holds to a belief in that free moving and investigating intelligence which not only makes science itself possible, but also makes secure the foundations of the ethical life. Any world in which the scientist can do his work gives us the sort of free observation and decision which make possible moral responsibility and moral action. The activities of the scientist are only possible in a world which also has room for ethics. The ethical control of the materials of conduct follows naturally from the personal activity which creates science, and the personal control which uses its principles to change the face of the earth.

The critical scientist makes another significant and far-reaching discovery. He finds that there are certain assertions you can only make verbally. You cannot make them with thoroughgoing authenticity. And you are found to deny them actually at the very moment when you make them verbally. This is true of all views of existence which would reduce the whole body of experience to a mechanical basis. If you affirm that reality is just a great machine, you yourself have to be outside the machine in order to make the affirmation. It is not strange that a witty thinker said of Dr. John Watson that he had made up his windpipe that he had no mind. Dr. Watson believes in machines—first, last and all the time. But the whole object of his study is the formulation of methods by which these machines can be controlled. Of course, in working out these formulas he has already ceased to be a machine. And it is only by being more than a machine that he can apply them. All the extra mechanical sanctions which he so glibly and arrogantly denies step into his own speech as unnoticed assumptions. He must use elements for which his system does not provide every time he conducts an experiment. And his own exposition in its fundamental assumptions and technique of convincing the reader's mind is a complete and successful refutation of the views which he would commend. A Behaviorist is the best possible answer to Behaviorism. Because he sees that free moving and responsible intelligence can only be denied verbally, and that in the very argument in favor of the denial we must stultify the position we are defending, the critical scientist holds to be firmly established all the positions which are fundamental for the very existence of ethics. The world in which the scientist does his work is the very world of moral responsibility and moral action.

VIII

But the serenity of the critical scientist is now disturbed in a new fashion. The tumult and the shouting have not really died away. He must prepare to receive the full explosive energy of an attack of heavy artillery and through the smoke barrage which has been thrown down he detects the forms of advancing foes. In the name of biology the new attack is made. Consciousness and the mental life he is told are themselves the product of evolution. They slowly emerge in the long struggle for survival. The process itself is coldly impersonal. They are thrown off in the movement of great unconscious forces. You cannot crown energies which themselves have slowly and painfully evolved in an impersonal order. You cannot with any sort of adequate justification look upon these by-products of evolution as expressing its essential meaning. You cannot put free intelligence upon the throne of the world. For it has been produced by the long process of biological evolution. And you cannot explain a process by its own product.

All this, and much more, said with vivid rhetorical flourish, sounds rather unusually impressive. And if it is true we seem likely to come back again to Mr. Krutch's Slough of Despond.

Here if anywhere the critical scientist must do close and penetrating and decisive work. And he need have no hesitation as he approaches his task. First of all he reminds us that lowly origins in no way affect the value of actual elements in existence when once they arrive. A poet may eat an interesting morning meal of bacon and eggs and muffins and coffee. Later, after all this has become bone of his bone and flesh of his flesh and blood of his blood, he may write a sonnet. In a sense you can establish a direct causal series between the sonnet and the bacon and eggs and muffins and coffee. But as a matter of fact, once the sonnet is in existence it exists in its own right and must be judged by standards related to its own qualities. The grunting of swine and the cackling of chickens and the swish of the wind blowing through fields of wheat will not help us to understand the subtle intellectual integrations represented by the sonnet. Lowly origins simply do not set the boundaries for those great products with which on one side they have a causal connection.

Grant that you can go back to a world where there are no signs of conscious creatures. Grant that you can go back to a world of consciousness without visible intelligence. Grant that you can think of a world of intelligence before the emergence of the sense of moral values. It is still true that at each new stage you have facts which stand in their own right. They are not less because you can think of them in the terms of lowly origins. They are not less because you can think of them in the terms of dim and unpretending beginnings. However it got here, once free moving and critical and deciding intelligence arrived it transcended the limitations of a mechanistic world. Until it arrived science was impossible. And once it arrived the path was clear for experiment and research and discovery and control. It was also free for the whole realm of ethics. The world had reached the point of moral responsibility and moral decision. There is no more subtle fallacy than that involved in the assumption that lowly origins make impossible vast and masterful developments. Such a position really understood would make the evolutionary process itself impossible. The critical scientist rests securely in the insight that clear and free and critical intelligence must have arrived before science was possible. We see with equal clearness that with their arrival the world of ethical distinctions becomes possible and indeed assured. The critical scientist may explain these epoch-making stages in the evolutionary process by some such principles as those set forth by C. Lloyd Morgan in the Gifford Lectures on Emergent Evolution. Or he may explain them in some other way. In any event, he knows that with the arrival of free moving intelligence we begin to live in a world where both science and ethics are possible. No examination of the family tree can invalidate the significance of intelligence. You do not judge it by its history. You judge it by its essential capacity. And the very power to think and to judge, to appraise and to decide, is the gift of that intelligence without which the very idea of an evolutionary process would never have occurred to the mind of man.

One other insight of the critical scientist is of cardinal importance. He sees very plainly that the view of the universe as a whole which the scientist accepts must make friendly room for that consciousness and free thought and free decision without which science itself could not exist. The arrival of these elements may have been late. But indubitably they have arrived. They have done a vast work in the world. And the universe must be one which has a place for that which actually exists. It must be friendly and not hostile to the processes which make science possible. The study of the vast achievements of the scientist in discovery and control of the uniformities of nature bears impressive testimony to this inherent friendliness. And any universe which has a place for the scientist has a place for the seer. Any universe in which there is room for science is a universe in which there is room for ethics.

IX

We can move forward from this firm foundation for our consideration of the ethical control of the materials of conduct in three ways. We can think of the ethical sanctions as they have been expressed by great teachers of morality. We can think of them as they have appeared in the moral experience of the race. And we can think of them as they have glowed brightly in the dreams of the great Utopians.

The turning point in Greek philosophy appears when thought becomes less a theory of things and more a theory of conduct. The end of the days of glittering external achievement on the part of the Greeks was the beginning of a new and searching study of the life of the individual in its motives and in its conduct. To the Epicureans some subtly distilled sense of pleasure lay at the root of ethical insight and ethical decision. To the Stoics nature itself presented a law which man must choose for his own and accept and to which he must conform. And here, as so often in the later history of thought, the assertions of a kingly necessity which governed all things could only be made verbally. If the Stoic denied freedom in one breath he had to assert it in the next. To accept the law of necessity was to transcend it and so the Stoic was at his best always greater than his system. To choose the higher pleasure meant that the Epicurean implicitly accepted a standard beyond pleasure. And so the Epicurean at his best was always transcending his system. The very pantheisms of India were all the while edged by a brightness beyond themselves. The choosing of the path to Nirvana was the assertion of the power of decision even on the road to the death of desire. The highly evolved gentleman of Confucianism was confronted by a standard urbane and ancient. And the life of that standard was renewed and given a new and beautiful quality with each new acceptance. The very repudiation of scruples which gave tone to the thinking of Machiavelli was based upon a conscious choice of ends. You have to be a moral person even to perform immoral acts. Spinoza fastened himself and his disciples in a universe of vast and unbroken determinations. Yet he, like so many others, found himself actually denying what he verbally asserted. For it was in the loyal acceptance of this universe that he found consummate joy. And to accept this universe it was necessary already to pass beyond its limits. The "social contract" of Hobbes was based upon the assumption of personal acceptance and personal decision. When Voltaire objected to almost everything almost everywhere, making his darting mind the instrument of an incarnate criticism, all his assumptions involved the existence of a world of free moving intelligence. The critic can have no function in an entirely mechanical universe. Rousseau's dream of life as expansive emotion is a moral philosophy of personality intoxicated with its own powers and possibilities. Kant's *Critique of Practical Reason* is a brilliant setting forth of the inevitable place of freedom in a world of law. The pessimism of Schopenhauer is a philosophy of personality turned stale and sour. Nietzsche's Superman is the exponent of a view of virile personality repudiating obligation in the name of self-assertion. The counting-house morals of utilitarianism are based upon the assumption of the presence of persons who can do moral sums. Evolutionary ethics assume the arrival of a type of intelligence which can accept and fight for moral values. Pragmatism and Instrumentalism would have no meaning apart from the presence of a critical intelligence which can appraise values and accept them and make them a part of the working force of the world. Either implicitly or explicitly or both implicitly and explicitly all teachers of ethics have assumed the possibility of the intelligent control of the materials of conduct.

A study of theories of the good life as they have spread themselves over the centuries reveals the fact that they have tended to supplement each other even when they seemed most contradictory. If freedom was degenerating into license, a theory of standards so firm that freedom seemed to disappear was brought to the minds of men. Pleasure asserted itself against a cold and overrigid conception of duty. Duty asserted itself against a hot and exotic and lawless conception of pleasure. The individual was lifted up when theories of society were about to crush him. The sanctions of society were asserted in the presence of mad conceptions of individual rights which would have wrecked society. Expansive emotions defied lifeless conventions. Noble standards defied emotions restrained by no inner check. A stable and subtle sense of integrated moral values emerges from a study of ethical theory. Plato's sense of a principle which would integrate all the elements of value in a harmonious synthesis becomes more and more powerful as we follow the thought about ethics during twenty-five hundred years and more. And all of this refined and subtle movement of ethical interpretation is the work of a critical intelligence which in the field of morals is the equivalent of that free moving mental life which is responsible for the achievements of science.

But men have had a history of living as well as a history of thinking. And man has two essential problems to solve. The first has to do with the harmonizing of the forces of his own life, so that his actions shall express one purpose and not the conflicting desires of a divided mind. The second has to do with the harmonizing of the individuals who make up society, so that instead of perpetually getting on each other's nerves, men shall live together in fruitful and organic coöperation each more fully himself because of all the others, all combining in a unity of life to which each makes a happy and creative contribution. Whenever in the individual one desire usurps a place not belonging to it in defiance of the rest, in tragic menace to the harmony of the whole, there comes about an inner anarchy which is the contradiction of the good life. Whenever in society one man or one group of men, one institution or one nation usurps a place inconsistent with the good of the whole, you have social anarchy. The achievement of individual integration is the task of personal morality. The achievement of social integration is the task of corporate morality. But corporate morality is the achievement of individuals acting on behalf of the whole. The history of mankind is the tale of the contention of the forces which have made for and against individual and social integration. In all this struggle mankind has instinctively made the assumption that it is possible to choose the way of harmony and turn from the way of disintegration. The very existence in all civilized languages of such words as virtue and duty, of praise and blame, of courage and cowardice, bear testimony to the sense of that freedom and responsibility which give ethics an actual foundation in the life of man. That same free moving intelligence which has created the sciences and controlled the forces of nature has as its great human task the integration of the life of the individual and the harmonizing of the life of society. This is the meaning and the purpose of the ethical control of the materials of conduct.

But men not only have a history of living and a history of thinking. They also have a history of dreaming. They are born Utopians. And "a map of the world which does not include a Utopia is not worth even glancing at." It is of the very nature of the mind of man in imagination to remold the scheme of things so that it will come nearer to mind and heart's desire. Plato stands at the head of all such disciplined dreamers with the magnificent achievement of the *Republic*. More's *Utopia*, Bacon's *New Atlantis*, Campanella's *City of the Sun*, Harrington's *Oceana,* Morris' *News from Nowhere,* Hertzka's *Freeland,* Bellamy's *Looking Backward,* and Wells' *Modern Utopia,* are separated by curious differences even as they are united by significant ties. They all assume the significance of the dreamer. They all assume the intellectual and moral and social significance of his dreams. And they all assume that something can be done in the direction of making the dreams come true. This may be said also of the various dream worlds which the socialists have made. Like the scientific mechanist the social and economic determinists always manage to transcend their systems in their Utopian thinking. The system is really little more than a dependable series of formulas which free moving intelligence can use. In Utopia as in the real world determinism is always verbal. So the world of the Utopian is a world where freedom and responsibility must be assumed in order to explain the emergence of the Utopia and in order to give its ideal pictures any power to seize the minds of men. Utopian thought is ethics illuminated by imagination. Even the mistakes of Utopian thinkers would be impossible in a world where mental freedom has ceased to exist. The same sort of daring intelligence which becomes a discoverer in the scientist, in the Utopian becomes a dreamer. The false Utopia is based upon lawless phantasy. The true Utopia reflects the fundamental stabilities upon which truly creative living rests. True or false, they involve that exercise of freedom which is basal in the moral life.

X

When duty whispers "Lo thou must,"
The youth replies "I can."

So we come upon the heart of the whole matter. And nothing in the history of science or the history or morals invalidates this central insight. We misunderstand science when we turn mechanists. We misunderstand morals when we turn mechanists. The materials of conduct find their very significance in the fact that they are subject to ethical control. And even our Utopian dreams are an expression of that freedom which cannot be divorced from responsibility.

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CHAPTER IV

THE ÆSTHETIC CONTROL OF THE MATERIALS OF ART

MR. JAMES LANE ALLEN once wrote a curiously interesting novel entitled *The Reign of Law.* The central character was a young man who as a theological student found his intellectual world shattered by the conception of a universal law exercising a mathematical control over the whole universe. The young man found himself caught in a cage. He was a part of a closed and uniform system. All the things which had made religion priceless seemed shut out of this complete mechanism. This story has been told with many variations and with many types of approach by many writers. But it has not always been seen that the problem did not relate itself merely to religion. It had quite as much to do with art. The water-tight system of impersonal law, if it did indeed cover the whole area of reality, was as little a friend of art as a friend of religion. One of the men who saw this clearly was Theodore Watts-Dunton. And he wrote his intense and searching novel *Alwyn* to protest against a view of life which would rule out of existence all the free and creative activities of the artist. Life, he was all the while saying in effect, is larger than the impersonal formulas which are offered by the physical sciences. The artist was finding that such a universe as that of these formulas (providing they covered the whole of reality) was like a world from whose atmosphere all the oxygen had been taken. He simply could not breathe. And so right belligerently men like Watts-Dunton rose to protest.

Various attitudes toward the whole situation were possible. One could grimly accept the new and determined universe and write the story of it with hard candor shot through with flashes of terrible irony. In such a spirit Hardy did his work. And so he became the chronicler of a world whose deadly laws held men in a clutch from which there was no escape. The tale of the puppets who had no choice of their own could be told with exquisite and meticulous skill. And the somber clouds hanging in a sky from which the last purple light of the sunset of freedom was fading had a certain terrible beauty. The artist in a few words of austere dignity conducted the obsequies of freedom in a world of unchangeable law.

It was possible to find a purely emotional escape which had nothing to do with the stern demands of the intellect. The exotic romanticism of Rousseau was in the blood of many an artist, and it was easy for many men to attempt to escape from science as

Rousseau at an earlier period had tried to escape from civilization. If you do not like facts ignore them. If you do not like reality forget about it. Take the wings of the imagination and fly off to some ivory tower whose beauty is untouched by hard and sordid facts. Seek some blue flower of the dreamland of the spirit of man and contemplating its rare and radiant loveliness forget the laws of chemistry and the laws of physics. Keep a shrine of the imagination in a temple whose central altar is devoted to the worship of hard cold disillusioning facts. Few nineteenth century poets entirely escaped this mood. And some quite surrendered to it. When Tennyson wrote "The Idylls of the King" he was escaping from the difficulties of a world he had to face when he lifted the troublesome questions of "In Memoriam." Matthew Arnold found the same sort of escape in "Sohrab and Rustum" even as he wrote words of sad and wistful beauty to tell the tale of the depleted vitality of the modern world in "Dover Beach" and nostalgic words of pensive memory of lovelier days in "The Scholar-Gipsy." The mood which made possible the writing of Dante Gabriel Rossetti's "Blessed Damozel" is closely connected with the desire for escape. The medievalists are all the while creating through the historic imagination a world nearer to the fashion of heart's desire. When you feel the glamorous beauty of the Celtic movement in the writings of such poets as Yeats, you have an amazing achievement of emotional escape from the hard necessities of the modern world. The mood has persisted and gained distinguished expression in the lovely dreams of Lord Dunsany.

Then you may have a virile insistence that personality is still the center of any world of which man can think with validity and in which he can live a human life. Right through the doubts and hesitations and defiant protests of the age when the physical sciences began to take their places on thrones to judge the tribes of Israel, Robert Browning, hearty and happy and quite undisturbed by the web which spiders of the mind were spinning about him, kept singing and summoning the heroic in men and crying with unhesitating assurance "Life's business is just the terrible choice."

To those who really accepted the mechanistic universe it gradually became clear that light had been taken out of the sky. The sun did not shine so brightly by day. The stars did not twinkle in such bright and merry and friendly fashion by night. At first one could write sad beautiful sonnets to describe one's loss. Or one could pen novels of cold and stately analytic power describing the devastating illusion of freedom in a law-bound world. But gradually the interest in this sort of thing began to pass. The sources of inner vitality began to show signs of depletion. The fountains of creative energy began to play fitfully and spasmodically. To those who were clearly and judicially observant the decay of the artistic impulse began to be clear as they looked upon many promising and gifted young men and women who had lost the light out of their eyes. If the soul was gone the body was left. And there were artists, some in hard and sullen anger, some in ugly happiness in letting the inhibited desire for licentious speech express itself at last, who opened the floodgates of lawless frankness and allowed the body to speak for itself. It had not been so easy in the Western world to play the devil with an unchaste imagination since the most decadent days of the Classic Age. Abnormal and unnatural vices came forth from their dark, damp dwelling places, turning terrible and bloodshot eyes at the unaccustomed light of the sun. And then there was ennui, and utter emptiness. Or there was a nauseated sense of the utter filth to which life had been reduced. The critic who offers a bibliography of this sort of thing is in danger of suggesting that which will be sought out and devoured by unhealthy minds. And that privilege at the moment I will not claim.

Frequently the moving of the creative impulse in the artist was expressed in less tragic ways. He was contented to do small things skillfully rather than to attempt larger things. He tried to gain in technique what he had lost in inspiration. He said with extraordinary skill that which was not really worth saying at all. Or he invented new techniques and new methods of expression, making clever verbal juggling the substitute for thought, and odd rhetorical devices the substitute for noble artistic expression. Rather pathetically the little mice ran about the trap, now and then darting ferociously against the wires. But the trap—so the mice believed—had no doors. And its wires though slender and thin were very tough and strong. They did not break. And the mice moved about in the trap. Sometimes you caught a strange tragic light in their curious eyes.

I

But is the world of unchangeable uniformities the last word of science? Does the impersonal system of mechanical relationships exhaust the meaning of reality? Did the artists accept the newly offered universe too soon? Was the system in which they believed themselves slaves itself an illusion? Was the trap itself only a device of a certain type of scientific imagination so that at any time the mice might have gone free?

In 1927—January to March—Dr. A. S. Eddington, Plumian professor of Astronomy at the University of Cambridge, delivered the Gifford Lectures in the University of Edinburgh. The lectures were published substantially in a volume entitled *The Nature of the Physical World.* In the introduction to these lectures Dr. Eddington says very frankly: "I am convinced that a just appreciation of the physical world as it is understood today carries with it a feeling of open mindedness toward a wider significance transcending scientific measurement which might have seemed illogical a generation ago."[1] Later he declares: "The view here advocated is tantamount to an admission, that consciousness looking out through a private door, can learn by direct insight an underlying character of the world which physical measurements do not betray."[2] After many pages of intricate and technical exposition, Dr. Eddington declares: "All I would claim is that those who in the search for truth start from consciousness as a seat of self-knowledge with interests and responsibilities not confined to the material plane, are just as much facing the hard facts of experience as those who start from consciousness as a device for reading the indications of spectroscopes and micrometers."[3] Professor Eddington feels that he is justified in saying that as a consequence of the advent of the quantum theory "physics is no longer pledged to a scheme of deterministic law."[4] You are coming to the very heart of Professor Eddington's position as you hear him say: "Recognizing that the physical world is entirely abstract and without 'actuality' apart from its linkage to consciousness, we restore consciousness to the fundamental position instead of representing it as an unessential complication occasionally found in the midst of inorganic nature at a late stage of evolutionary history."[5] Very significant is this assertion of Dr. Eddington "but science has also to explain if it can, or else humbly to accept, the fact that from this world have arisen minds capable of transmuting the bare structure into the richness of our experience."[6] Again Professor Eddington is almost startlingly frank when he says: "That overweening phase when it was almost necessary to ask the permission of physics to call one's soul one's own, is past."[7]

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[1] *The Nature of the Physical World* (Macmillan), p. xvi.
[2] *Ibid.*, p. 91. [3] *Ibid.*, p. 288. [4] *Ibid.*, p. 294.

The shout of joy which rose from the lips of no end of men when they read *The Nature of the Physical World* and saw its significance in respect of a view of reality based upon the admission of freely moving and critical consciousness was natural and not without justification though the ground of Professor Eddington's positions must be analyzed carefully before we arrive at a judicial and secure estimate of their significance. No serious student of the relations of science and philosophy would for a moment think of resting the whole case for critical and creative consciousness on deductions from the quantum theory or the admission of a principle of indeterminacy into the activities of physics. The world to which Einstein has introduced us may come or go. The primacy of critical consciousness remains untouched. For as a matter of fact the positions to which Dr. Eddington comes and the admissions which he makes do not at all depend for their final validity upon the theory of relativity. It was writing of the Newtonian epoch that Mr. Dampier-Whetham declared: "Materialism cannot even refute Berkeley's idealism, at the opposite pole of thought. It cannot survive the destructive analysis of any critical philosophy."[8] At the same time it is greatly heartening when a physicist of commanding position puts the case so stoutly for consciousness as has been done by Dr. Eddington. It is good to have a similar position reached through a somewhat different approach powerfully set forth by Professor Whitehead. It is good to have Dr. J. S. Haldane, when president of the Physiological Section of the British Association and later, striking stalwart and deadly blows at the mechanistic theory. In his little book *Mechanism, Life and Personality* Dr. Haldane in one chapter puts the case for the mechanistic conception of life with brilliancy and force. In the next chapter, entitled "Criticism of the Mechanistic Theory," he sets about the work of destruction of that view with great gusto and with immense intellectual power. "It was only through the prevailing ignorance of physiological facts," he says, "that the physiologists of the middle of the last century imagined that they were approaching a physico-chemical solution of elementary physiological problems."[9] He leaves no room for misunderstanding of his own position. "I should as soon go back to the mythology of our Saxon forefathers as to the mechanistic physiology."[10] "The Mechanistic theory of breeding," he says, "is not merely unproven, it is impossible."[11]

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[5] *Ibid.*, p. 332.

[6] *Ibid.*, p. 335.

[7] *Ibid.*, p. 344.

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[8] *A History of Science,* p. 216.

It is clear enough, then, that if the artist and the critic insist upon being imprisoned in a mechanistic universe, they do this in spite of resounding and authoritative voices coming from the scientists with the assertion that no such universe really exists. Sometimes it would seem that certain men of letters insist upon being controlled by the inadequate philosophical positions which were the by-product of a stage of scientific development which has already been passed. Speaking of elements in the situation which gave materialism a certain powerful vogue, Mr. Dampier-Whetham says: "This happened *for a while* in the nineteenth century."[12] (The italics are mine.) Perhaps some artists have not been following the development of science very closely. They have been interpreting an imaginary universe which has already ceased to haunt the minds of really critical thinkers.

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[9] *Mechanism, Life and Personality* (Dutton), p. 46

[10] *Ibid.*, p. 61.

[11] *Ibid.*, p. 58.

[12] *A History of Science*, p. 216.

II

Louise Imogen Guiney expressed perhaps even more than she herself realized in some of the lines of her poem "The Kings." First she pictured the grim battle in which it seemed that the individual must be overcome. But right against the tragic and doubting words rings the challenge of a brave defiance. And in words of heroic assurance she expresses her faith that the aroused will is stronger than fate. Man is here to master his environment and not to surrender to it.

The truth is that the artist by his very nature transcends the mechanical uniformities of the world of which he is a part. The very existence of the mind of the artist, feeling the pulse of an age and setting its deepest thought and most poignant feeling to music, means that at another point there has arisen that free moving conscious life which can be held in no prison of impersonal forces. Just as the scientist must transcend the uniformities with which he deals in order to discover them, so the artist must rise out of the mechanisms of life in order to conceive of them and to describe them. When we have seen this clearly we are ready to appreciate the subtle and penetrating remarks of Professor Robert Shafer in an essay on *An American Tragedy*. He has shown how Theodore Dreiser has so selected and manipulated the "facts of experience as to deny through his narrative, that human life has any meaning or value." And the sentence we now quote carries the sudden flash of critical understanding. "Hence no one is really responsible for anything—save perhaps the artist who sees this important truth, at length, and by careful selection of appropriate material is able to picture it for us." [14] In other words, only an artist with a free moving and responsible mind can describe an irresponsible world. But a world which can produce such an artist has ceased to be a world of irresponsibility. And thus Professor Shafer is able to say with entire finality that Mr. Theodore Dreiser "has in his own person, against his own literary aim, furnished a convincing refutation of his philosophy." [15]

And this illustrates and confirms our contention that the artist is related to the materials of his art just as the scientist is related to the materials of his science. Or to put it in another way, a world which has made room for the free moving intelligence of the scientist is just the sort of world where the artist can live and thrive. And it is just the sort of world in which moral values can emerge with real significance. Anyone who has understood the scientist is in a measure prepared for the moral hero and the powerful artist. The scientist by means of his free moving intelligence discovers and controls the uniformities of nature. The moral hero by means of his free moving intelligence comprehends the sanctions of ethics and chooses to obey them. The great artist by means of his free moving intelligence apprehends and indeed often constructs the world he is to describe, and sets forth its lines and colors with creative power. The real universe has produced science. It must be interpreted in such a way as to make room for the scientist. It has produced morals. It must be so interpreted as to make room for the moral hero. It has produced art. It must be interpreted in such a fashion as to make room for the artist. In each case personality is on the throne.

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[14] *Humanism and America* (Farrar & Rinehart), p. 162.

[15] *Ibid.*, p. 167.

III

But it is not personality in a lawless world. Science is an achievement at the meeting place of freedom and law. The freely moving mind of the scientist discovers the physical uniformities. Ethics is an achievement at the meeting place of freedom and law. The moral hero freely decides to accept and obey the moral sanctions. Art is an achievement at the meeting place of freedom and law. It represents the wedlock of liberty and discipline. So we reach the stage of our argument when it is necessary to consider the æsthetic control of the materials of art.

There are two aspects which belong to the work of the artist. One has to do with creative passion. The other has to do with creative control. If you have passion without control in the name of permanent sanctions, you have the unleashed fury of lawless emotions. In this respect Jean-Jacques Rousseau opened the floodgates for the modern world. The tale of that expansive and lawless emotion which has come near to debauching the society of the west has been told with brilliant insight and cutting criticism by Professor Irving Babbitt in that masterful book *Rousseau and Romanticism.* On the other hand, if you have control without the play of living and creative energies you come upon a pseudo-classicism, hard with stony convention and exhibiting itself in impotence and sterility. Each extreme has its own bitter and ugly tragedy. But if Bergson's "Elan Vital" is likely to form a stream of anarchic energy, Professor Irving Babbitt is ready to suggest something better. He sees that the vitality must be kept. A stiff and starched conventionality will never do the works of genuine art. He describes a control which will guide without depleting that rich energy which is always present where abounding life is found. So he suggests *Frein Vital* (Vital Control). So we are to find the ways of discipline joined in wedlock with freedom. So we are to see a creative vitality checked and guided and controlled by noble standards.

Sometimes the struggle between the two conceptions—of expansive emotion and of noble discipline—has been long and bitter. And in the heat of the struggle the possibility of a higher unity has often been lost to view.

The whole quality of the conflict received dramatic expression in the life of the late Stuart P. Sherman, a critic who achieved high eminence in the United States. Coming of New England stock, he was born in Iowa and felt the exotic beauty of California and the rough vigor of mining life in Arizona as a boy. New England put its hand upon his young manhood. He took his course in Liberal Arts at Williams and received his doctor's degree majoring in English at Harvard. It was at the university which flies the crimson banners that he came under the influence of Professor Irving Babbitt. Later Sherman set down his impressions of this powerful teacher: "He came in with a bag bursting full of books, and took out a handful of notes which he arranged around him. . . . He deluged you with the wisdom of the world; his thoughts were unpacked and poured out so fast you couldn't keep up with them. . . . He was . . . driving you into a reconstruction of your entire intellectual system. He was at you day after day like a battering ram, knocking down your illusions. He was building up a system of ideas . . . You were dealing with questions on the answers to which the welfare of nations and civilizations depended. He himself seemed to know the right answers and was building a thoroughfare of ideas from the Greeks to our own day." [16] In these days Sherman was exposed to the full artillery attack upon the expansive lawless expression of emotion which characterized the activity and art of a standardless life. With his own quick intellectual response the sense of the significance of noble control and of the potency of permanent standards made a profound impression upon the mind of the young student. Later as a contributor to the *Nation* in the days of the editorship of that master of erudition, Dr. Paul Elmer More, Sherman was in close and significant contact with a mind which like that of Professor Babbitt was perpetually insisting upon the place of standards in a world which had set its face toward lawlessness. And in time he won the friendship of that stately and meticulous critic, W. C. Brownell, in whom the noble old tradition of art built about the wise control of vital energies flourished. So in his formative days Sherman made the classic tradition his own. The Elder Statesmen of Criticism welcomed him to their minds and hearts. And when he unsheathed his sword he was ready for fierce and belligerent contention with the lesser breeds without the law. His volume of essays *On Contemporary Literature*, published by Henry Holt in 1917, gave brilliant and commanding expression to a conception of art based upon the control of all the vital and expansive forces of emotion by standards whose mastery gave coherence and harmony to art as they were basal to the true and vital orderliness of experience itself. The young apostles of lawlessness in art in all the newspaper offices leaped upon Sherman in battle array. He seemed a splendid young literary Athanasius Contra Mundum. And he gave immense satisfaction to many quiet lovers of orderly beauty in art and life all about the United States.

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[16] Stuart P. Sherman, *Shaping Men and Women,* Introduction, p. xxi.

As the years passed close observers detected subtle changes in Sherman's attitude toward the great matters which he discussed. And when in 1924 he resigned his professorship at the University of Illinois and entered upon the responsibilities of a literary editorship in New York City, his whole accent changed. His ample erudition, his flashing and persuasive and pungent pen were at the service of the cause against which he had done such valiant battle. To be sure, he could not completely cast aside a taste formed through the long discipline of his sternly studious years. He could not forget that sense of standards which had become so integral a part of his mind in the days of potent stimulus at Harvard. But he seemed now to make a kind of god of driving, potent energy. The vital was the authentic. The push of hot impetuous feeling was to have the right of way. The passionate urge of life was not to be blocked. To escape from that which bound the throbbing energies of one's spirit and to adventure upon uncharted seas of vivid living and feeling now seemed to him a thing infinitely alluring. "Any unusual display of energy" caused his mind to flutter as a moth moves toward a light. He became fearful, it is clear, of lifting a flag which to use his own words in another connection would "rally only, or mainly, those gap filling persons who could not be blasted out of their sterile conventionality with dynamite." [17] He felt that youth "rallies only to some positive object for expansive and creative energies." [18] He had decided to go with the current. To be sure he would use his oars for a bit of direction occasionally. Now and then he would turn and row upstream for a moment. But on the whole he would go with the hot, impetuous, tremendous movement of life and not against it.

There was more sadness than anger among his old friends. There was surprise and then unmitigated delight among the apostles of the Flux who saw him lifting up their banner. And so Stuart Sherman made the great refusal.

Here in a bit of biography warm with the life of our own time, you have the tale of the subtle baffling difficulty of the struggle, and of the strange, curious ease of defeat. The last word of Sherman's criticism was not "control." It was "surrender."

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[17] Zeitlins and Woodbridge, *Life and Letters of Stuart P. Sherman*, Vol. 2, p. 713.

[18] *Ibid.*

IV

It is easy to see that in periods of sterile and lifeless convention young artists tend to experiment with unleashed emotion. It is easy to see that in periods of unabashed and unchecked lawlessness voices inevitably arise to speak in the name of permanent standards and high control and of the inner check. The important point in respect of our immediate discussion is to see that the artist and the critic are exercising the right of judgment and decision in all this process. Even when they decide in favor of the play of lawlessness they are exercising that quality of personal judgment which lifts these activities quite above the impersonal mass of things. You cannot make even the Great Refusal without being a person.

But the exercise of personality to lift the flag of expansive emotion leads upon a highway where one travels toward a destination of disillusionment and cynicism at last. There is no permanent satisfaction in unleashing undisciplined emotions. The art which is freely running riot leaves a very bad taste in the mouth at last. Any enthusiasms unchecked by wise analysis and undisciplined by noble control will have an ugly revenge in the end. You begin by being an uncritical sentimental idealist. And if you travel the whole road you conclude by being a bitter and even a cruel cynic. If we do not control the materials of art by high and permanent standards, life at length speaks to us in unmistakable terms. The depletion of the vitality of an age through art which is the expression of instincts which own no master and passions which know no check and desires which know no law, brings about an hour when the apostles of lawlessness in life and art hear the approach of ominous armies coming to reassert the standards which they have defiled. As Robert Browning says in "The Ring and the Book," after describing great moral darkness, "I knew a necessary change in things."

To be sure, the materials themselves put certain limits upon the expansive desires of the artist. There are some things you cannot do in architecture because the building you are erecting would not stand if you did them. The engineer who dwells in the corner of the mind of every architect will have his say on occasions. And when he speaks there is no choice but to obey. And from the engineering side of the enterprise there comes a sense of the work of the builder as an activity characterized by economy of materials and effort and simplicity of design. The engineer himself comes to have a feeling for what may be called the individuality of particular materials, and so there comes the sense of limits and standards and a subtle perception of architectural propriety. But outside those fundamental relationships of mass and form which are involved in giving a building stability and permanence, the architect can accept or reject all the suggestions which rise so subtly from the experience of past builders and engineers. He can erect a building which will stand and yet a building which is angrily fighting the materials of which it is made and the environment in which it is placed. Or with a subtle apprehension of these meanings he may, like the Greeks, erect a building so much a part of the landscape that you can scarcely imagine a particular hill without its crowning temple. And he may so use his materials that they seem to dictate the very form which he gives to them. Here we come upon a region for critical investigation, for clear and penetrating thought, and for unhesitating decision. The whole life of a period has a way of speaking—always of offering to speak—through the characteristics of contemporary art. The subtly integrated harmonies of Greek architecture capture the spirit of Attic life and turn it into stone. The heavy and dignified magnificence of Imperial Rome had a natural fruition in the great dome and the weight and mass and strength of Byzantine building. The exquisite, airy other worldly dreams of the Middle Ages found subtle kinship with the flying buttress, the pointed arch, the piercing spire, indeed with the whole quality of Gothic architecture. The meticulous loyalty of men of a particular period to what they feel to be the true genius of its life is part of the very achievement of æsthetic control of the materials of art. The artist of fifth century Athens is thinking of elements exquisitely integrated so that they become part of a complete and harmonious whole. The artist of the Middle Ages is thinking of exhaustless aspiration. Even the stones he places one upon another must be taught to express the outreach of a moral and spiritual hope which goes on forever, each satisfaction opening new vistas of expectation. In all these ways the artist is provided with standards sometimes consciously, sometimes implicitly held in his mind. And this is as it should be, for as Mr. R. G. Collingwood acutely observes in speaking of drawing: "In order to check our ability to do exactly what we want, we must first know what exactly it is that we want, and we must then be able to compare this with what we have done. Otherwise, whatever line we draw may be, by an easy self-deception, represented as the very line we wanted to draw."[19] Here in a sentence we have expressed the whole difference between a disciplined loyalty to standards and a complacent acceptance of the actions in which our mood flows out as itself giving the standards to which we will be loyal for the moment. (I will be faithful to you, Cynthia, after my fashion.)

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[19] *Outlines of a Philosophy of Art*, Collingwood.

The very meeting of material and form in architecture under the hand of the artist makes it clear that the inherent qualities of the material world make it possible for that which seems so hard and solid to respond to the mastery of ideal conceptions. Even the ruins of the Parthenon give you a sense of materials subjected to the control of purposes which are not material. And so you move on to ask what possibilities of expression lie unrevealed in the materials of the physical world. At once it is clear that certain mechanical relations are already expressed in the material world which in this respect does not wait for the control of the artist. If a boulder loses its equilibrium it rolls down the side of the mountain. These mechanical relationships of mass and force and all the rest may be said to constitute the character of the material world. And in building a house or in building a ship the laws of mechanical relationship may almost be made visible, and so the work attains a certain artistry. But the material world is also a world of life and so the vital energies seen in vegetation and the pulsing forces of animal life are actually expressed in nature itself. And these vivid and dramatic qualities may find another expression in works of art in which they are seen as part of the pageant of this astonishing world. There is something of the vegetable in man. There is a good deal of the animal in man. But it is with the coming of observation and thought and foresight and decision that the distinctly human values emerge. Now mere mechanism becomes the vehicle of intelligence. Now mere vitality becomes the servant of will. Now the passionate intensity of undisciplined desire feels the hand of masterful control upon it. In this mastery over mechanism and vitality and untempered lustful passion, man comes to his birthright. And in the achievement of this mastery, in the struggle for its attainment, in the glory of success and the tragedy of failure and the dauntlessness of hope you find very notable and very significant materials for art. The denial of the contrast, the ignoring of the struggle, the reduction of the human to the mechanical or the merely vital or the merely animal, is the fundamental lie of bad art. The refusal to recognize the place of personal control of sub-personal forces is the repudiation of the profoundest assertions of life itself. And the disciplined intelligence which gives adequate expression to the struggle and the tragic failure and the glorious victory of the personal life, is using a technique which in the subtlest way reflects the very quality of the materials which it is interpreting. There may be greater heights for the artist to climb. But at least it is clear at the point which we have now reached that just as he must achieve personal control of his materials to be an artist at all, so the interpretation of the harmonies achieved through personal control is a central task of art.

V

The scheme of education originating in the ancient world and coming to full organization in the Middle Ages consisted, as we have already seen, of the Trivium and the Quadrivium. The Trivium was made up of grammar which studied the structure of speech, of rhetoric which investigated persuasive and beautiful speech, and of dialectic which investigated rational speech moving from position to position according to the relationships inherent in logic itself. The Quadrivium applied itself to arithmetic, the mathematics of numbers, geometry, the mathematics of surfaces and solids, music, the mathematics of sound, and astronomy, the mathematics of the stars.

Music has been described as audible mathematics, and while there is an element of direct sense appeal and a relation to movement which are hardly included in this description, we can understand the sentence of a certain thinker who said that the charm of music lay in the fact that it enabled you to count without knowing that you are counting. Mathematical relationships themselves become bright and luminous and warm and glowing things in the great music of the world. Was it Bertrand Russell who defined mathematics as the science of the relationships of objects conducted without any interest in the question as to whether objects existed which were capable of having these relationships? In any event, if mathematics is the study of the logical structure of relationships imaginary or real—the complete and perfect abstract science, music is the perfect abstract art. It was a significant epoch in music when words were dropped into the background and instruments replaced human voices in the most characteristic productions. "Not only are voices incapable of sounding readily and with certainty many intervals, but they are confined to a range of a little over three octaves, and to phrases short enough not to overtax the breath. Instruments are free from all these disqualifications. They produce pure tones, without words, the most celestial of artistic materials; they can sound any interval; they extend over a range of more than seven octaves from the deep bass of the organ, or contrabass, to the shrill and immaterial treble of the piccolo; and the breadth of the phrases they can produce is limited not by their own mechanism, but only by the power of intellectual synthesis possessed by listeners."[20] Thus when the instrumental range and accuracy are freed from the limitations of words and the human voice, you have a singularly ample opportunity to express what may be called the mathematics of the emotions. And here again you have that singular meeting of freedom and law which we have already seen in the work of the scientist, in the very nature of ethics and in our analysis of the meaning of the arts. And here again we confront the requirement of the combination of liberty and discipline in the work of the artist himself. The mind capable of apprehending all the complex and subtle relationships of a great musical composition has the most ample freedom of movement and the capacity for apprehending the most definite and unchangeable relationships. But the very comprehension of all this firm structure of mathematical logic in respect of sound gives to the composer a realm in which he moves with the amplest freedom. Like the pilot who moves through the air in constant obedience to numberless physical laws and by his very obedience transcends them, so the musician achieves his greatest flights by an obedience to the laws of the mathematical relationships of sound. And by his very obedience he transcends the laws which he obeys. The uniformities themselves would never make the aeroplane on one hand or the sonata on the other. Free moving and creative personality dealing in disciplined skill with the mathematics of sound creates the great music of the world.

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[20] Mason. *Beethoven and His Forerunners* (Macmillan), p. 33.

VI

The artist who uses words as his materials also works at the spot where uniformity and freedom meet. Words are of themselves quite mechanical and conventional instruments of thought. But if you are going to have the freedom of any language you must begin by accepting its conventions. There is a wild tale of a young radical who was filled with sentimental sympathy for the letters of the alphabet. For how many centuries of crushing tyranny "A" had had no choice but to be "A" and "B" had been held with hard autocratic sternness to being "B." Obviously "A" should be allowed to travel up and down the scale and to have the ripe and rich experience of being all of the other letters of the alphabet in turn. And they, poor crushed creatures, should have the same freedom. The young radical was so delighted with this splendid and emancipated insight that he determined to write a great and luminous novel about it. But in order to write the *Uncle Tom's Cabin* of the Alphabet, to hasten the day when the shackles would be struck from every letter from A to Z, he had to use the letters in the same old conventional way to spell the same old conventional words. Only by means of obedience to the laws of language could he make his plea for linguistic license comprehensible. And somehow the inherent contradiction was so palpable that he lost enthusiasm for the task.

From the beginning to the end the work of the literary artist is an illustration of the reign of law. From a stately paragraph of noble prose to a subtly integrated sonnet, from a pure example of poetry according to classic forms to the most startling exhibits of *vers libre*, the artist moves through a perfect network of laws. The man who turns from classic forms simply repudiates a few of the sanctions of poetic expression. Even *vers libre* would be incomprehensible if it were not carried in chariots of convention which without hesitation it obeys.

Yet in all this network of laws of expression, freedom reigns. There is no law of iron necessity by which the letters leap together to form the words and the words join hands to form the sentences of one of Shakespeare's sonnets. A free and creative mind uses the laws of expression for his own fresh and individual purpose and so there comes to be something entirely new in the world. So the free mind of the artist and countless subtle sanctions meet when Æschylus creates the *Agamemnon.* So liberty and uniformity meet when Dante creates *The Divine Comedy.* So the free mind and the laws of expression and the laws of beauty meet when Shakespeare creates *The Tempest.* So it is only in obeying that the artist finds the greatest liberty.

And the life the artist describes and interprets as well as the materials of expression subjects him to august laws and offers to him an ample realm of freedom. The truth of life must be expressed. And the author falsifies it at his own peril. He must not only tell the truth but he must set it forth in the perspective of the noblest and so the most authentic experience. To keep telling evil things which are true, and quite to ignore good things which are true, is to tell the very worst sort of lie. For the darkest and most tragic lies are always drawn by tiny horses of incidental truth. You cannot really tell the truth unless you tell the whole truth. And that means the truth seen in the moral and spiritual perspective which amply expresses the significance of the good, the beautiful, and the true. You have constantly to exercise the critical faculty in order to set forth even a little of the truth. You have to move with the vast freedom of a great understanding in order to tell that defining truth from which all lies have been cast out. So in a hundred ways the artist must be a free mind constantly using stable standards for purposes of expression and for the ends of interpretation.

Then as Plato saw so superbly very long ago, there is a great reality—a coherent, harmonious truth of things—which exists in its own right beyond the passing experiences of this transient world. The greatest artists have glimpses of this harmony beyond life's discords. They see, too, the fashion in which this ultimate beauty and truth and goodness flash through the materials of this temporal world so that the physical itself becomes incandescent with eternal meaning. So the greatest artists see the vision which inspires them and find the standards which guide them. And freely choosing to be the instruments of this ultimate reality they find in their own experience a reconciliation of that ancient conflict between liberty and law. They are forever delivered from the restless pessimisms which rack the world, as they find peace in the acceptance of the ideal order which haunts their minds. But just because this acceptance is a matter of free faith based upon critical appraisal, the artist is most free when he becomes the servant of an ultimate order of harmony which is the essential beauty of the world. He does not invent this beauty. He discovers it. But by a free act of faith he chooses to believe in it even if necessary against the world. And so he is most free when he finds his ultimate standards, and most a hero of liberty when he enlists under the flag of the Lord of Discipline in Art and in Life.

VII

Clearly, then, the world of the artist and the world of the scientist have profound kinships. Obviously the artist and the scientist may meet on common ground. Each must bring a free moving and critical intelligence to his activities if he is to do any real work at all. Each finds uniformities which he may master and control through obeying them. And each transcends the laws which he discovers in the very moment when he discovers them, and proves himself larger than the system at the moment when he masterfully controls its formulas through accepting them. In the hour of the action of creative personality becoming most creative through free obedience, the scientist and the artist meet. Their worlds are vastly different in many ways. But they reveal an amazing harmony when we survey them as the achievement of the personal life.

All artistry consists in the æsthetic control of materials mastered and bent to the expression of the qualities of harmony which constitute the essence of beauty. There is a great mechanism in the ship of the arts. But the figure at the wheel masters all this machinery so that he guides the ship to the port of his choosing. Even when—to drop the figure—he writes a novel to make it clear that men are puppets, his highly sophisticated account of human life is the best repudiation of his position. For puppets do not become sadly conscious that they have no freedom, and they do not write sternly sad and nobly honest books to tell the bitter truth about themselves. So when Thomas Hardy writes *Tess of the D'Urbervilles* he magnificently and with superb unconsciousness refutes his whole philosophy. And when that sad young man Joseph Wood Krutch wrote *The Modern Temper* he gave away his entire case. You must assume the powers of free and critical personality in order to deny them. This you must do—we have seen—in science. This you must do—we have seen—in ethics. This we now see you must do in art. Just because the æsthetic control of the materials of art has been achieved again and again the artist comes upon an indubitable conviction that life offers that freedom in a world of orderly sanctions without which art would die, without which indeed art could never have been. So by its fruits once more personality vindicates its place and power in the world.

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DANIEL GREGORY MASON, *From Grieg to Brahms*

CHAPTER V

SPIRITUAL CONTROL THE FINAL FACT OF THE UNIVERSE

THOMAS HARDY, caught in the coils of a baffling and inscrutable universe, often expressed his bewildered sense of the grim irony of things in verse of penetrating sadness. In "New Year's Eve" we hear the purposeless God speaking to the creatures he has unconsciously made:

Then he: "My labours—logicless—
  You may explain; not I:
Sense-sealed I have wrought, without a guess
That I evolved a Consciousness
  To ask for reasons why.

"Strange that ephemeral creatures who
  By my own ordering are,
Should see the shortness of my view,
Use ethic tests I never knew,
  Or made provision for!"[1]

Such words as these wrung from a searching and baffled mind have obvious and terrible pathos. But they have a significance far beyond the gloom which enfolded the mind from which they came. To Thomas Hardy they suggested doors of hope forever closed. To a good many readers they will suggest doors of hope definitely opened. For inevitably the query suggests itself: Must not the ultimate Reality be of such a character as to account for the greatest and best things to be found in the universe? Long before Thomas Hardy wrote of a baffled God bewildered at the sight of the marvelous things which had appeared in the world he had made, Robert Browning put the whole matter in just the opposite way in that great poem "Saul." There he argued that God must outrank man in every great quality which man possesses. And finally from man's power of unselfish love he rose to the thought of God as the mightiest and the most unselfish Lover of all.

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[1] From *Collected Poems of Thomas Hardy*, p. 261. By permission of The Macmillan Company, publishers.

The method and the material presented here suggest a slightly different approach to the whole matter. Here we are in a world with a vast number of uniformities. Very many of these have already been discovered by the scientist and have been used in the securing of practical control in the world in which we live. By its very nature the tremendous system lends itself to exploration by the knowing mind and to control by the power of masterful intelligence. And so we find ourselves face to face with the great question: Is the universe in the last analysis like the uniformities which the scientist discovers and uses or is it like the scientist who discovers and uses them? Is it a mechanical system held together by chains of hard necessity, or is it the free moving intelligence of creative personality lifted to the highest power? Machine or Person? The alternatives confront us with dramatic clarity.

Already, however, we have seen again and again in this discussion that the scientist transcends the machine. He has to transcend it in order to discover it. He has to transcend it in order to control it. In fact if there had been no scientists who transcended the uniformities of the physical and biological realms, we would never have known the characteristics of those realms. If no one had ever transcended the machine, we would not even know that there was a machine which you could transcend. The facts before us make it very clear, then, that the universe is not a vast mechanism completely held in chains of hard necessity. It is only by ignoring and then forgetting and then in effect denying the existence of all the scientists that you can believe in a vast impersonal machine whose extent covers the whole area of reality. And even then you have to be a person in order to conceive of the existence of the vast machine.

Quite clearly, then, the universe has made place again and again for the presence and activity of free moving intelligent personality. Is there not here, then, a clue to the ultimate nature of the universe itself? All our knowledge even of impersonal things comes through personal mental activity. All our control of the uniformities of the impersonal world results from personal action. The next step is clear and indeed inevitable. Personality is the ultimate reality of the universe. Spiritual control is the final fact of existence. The universe in its essential quality is like the scientist who discovers and controls the impersonal order. It is not a reality whose meaning is exhausted by the movement of impersonal machinery. In our own sense of conscious control we have a sure clue to the secret of the universe. In the history of discovery and control on the part of the great succession of scientists we find ourselves in contact with that which reflects the very nature of reality itself.

I

As a matter of fact, every attempt to develop a conception of the universe which leaves no room for free action and no place for spiritual control involves itself in the most astonishing contradictions. Professor Robert Shafer in a book of singular penetration, *Christianity and Naturalism*, has illustrated this inevitable characteristic of mechanical views of the universe in his analysis of the teachings of Huxley. After quoting Huxley's declaration that we are conscious automata able in many respects to do as we like, Professor Shafer goes on: "In what sense automata can do as they like I am unable to see. It makes no difference that they can do so only in some respects. To do so at all implies a genuine choice, which in turn implies a true volitional agent. Either the admission is a fundamental contradiction or it is meaningless. Moreover, Huxley goes on to discuss human life in terms which everywhere imply that we are in fact capable of genuine choices: and thus he unwittingly emphasizes beyond possibility of mistake, his own sense of the falsity of his assertion that there has never been, and can never be, any violent or unaccountable break in the chain of necessary, regular, natural causation. The existence of a single volitional agent is an unaccountable anomaly in Huxley's unitary natural order." [2] Any universe which contains as much free activity as Huxley implicitly admits, is a universe whose very response to such activity shows it to be friendly to spiritual control. As a matter of fact, nobody has ever been able to deny the free personal control which masters the uniformities of the physical and biological realms without at the same time affirming the very thing which was being denied.

The instrumentalism of Professor John Dewey is a contemporary case in point. Dr. Dewey's Gifford Lectures on The Quest for Certainty set forth his essential position in full dress. On the one side you have a world which by its very nature leaves no place for free moving personality. And yet on every page it is assumed that this world is subject to control. Indeed, the very genius of instrumentalism expresses itself in a critical discussion of the possibilities of control, the ends to be gained and the technique of making the data of experience instrumental in respect of great and significant ends. When he is dealing with the practical application of the instrumental philosophy Dr. Dewey is capable of being brilliantly helpful. On certain areas he has a mind of fairly uncanny acuteness and insight. But although he refers often to the processes of knowing, there is no reason for believing that he has turned his attention with any critical perception to an investigation of the conditions of knowledge. As naïvely as any of his predecessors he assumes the existence of a knowing agent who can hear his arguments in favor of the instrumental philosophy and can accept or reject them. With complete unconsciousness of the deadliness of his implicit admissions for his own philosophy he assumes the existence of directing intelligence which can apply the practical principles of the instrumental philosophy for the control of experience. If you build a theory of knowledge upon his unconscious admissions, it will have a secure place for that directing intelligence which is basal in a view of experience as subject to spiritual control. If you build a metaphysic upon his implicit assertions the world of personal reality which has disappeared under the cool and daring necromancy of his words, will emerge in full possession of the field of being as well as the field of knowledge.

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[2] *Christianity and Naturalism* (Yale University Press), p. 143.

The fact so clearly seen by Hume long ago that the rising tides of life overflow the banks of denial in respect of the great matters of free intention and directed activity, must be kept in our minds. No end of practical service can be rendered by those who work out successful formulas of control. And we will accept their services with due and deep appreciation. But when those who construct these formulas quite fail to analyze their own activities and so quite miss their significance, we must turn to clearer and sounder thinkers for guidance. If we become capable of detecting that subtle and unconscious philosophical legerdemain which is all the while denying verbally what it asserts implicitly we shall be saved from the lure of many a phrase which hides a fundamental fallacy. And when we have once seen that the principles whose denial is only made by a process which stultifies itself in the action are the fundamental principles for our guidance in the interpretation of experience, we shall begin to apprehend the meaning of that spiritual control which is the defining aspect of reality itself.

II

Professor Arthur Stanley Eddington, who often appears quite like an *enfant terrible* among the hosts of the mechanists has a way of applying what may be called critical scepticism to the assertions of the advocates of an impersonal universe. He is not afraid to be brilliantly flippant as in one of the most famous passages in his Gifford Lectures *The Nature of the Physical World*: "I am standing on the threshold about to enter a room. It is a complicated business. In the first place I must shove against an atmosphere pressing with a force of fourteen pounds on every square inch of my body. I must make sure of landing on a plank travelling at twenty miles a second around the sun—a fraction of a second too early or too late, the plank would be miles away. I must do this whilst hanging from a round planet head outward into space, with a wind of æther blowing at no one knows how many miles a second through every interstice of my body. The plank has no solidity of substance. To step on it is like stepping on a swarm of flies. Shall I not slip through? No, if I make the venture one of the flies hits me and gives a boost up again; I fall again and am knocked upwards by another fly; and so on. I may hope that the net result will be that I remain about steady; but if unfortunately I should slip through the floor or be boosted too violently up to the ceiling, the occurrence would be, not a violation of the laws of nature, but a rare coincidence. . . . Verily, it is easier for a camel to pass through the eye of a needle than for a scientific man to pass through a door. And whether the door be barn door or church door it might be wiser that he should consent to be an ordinary man and walk in rather than wait till all the difficulties involved in a really scientific ingress are resolved."[3] In less merry mood he gives the result of his critical analysis in downright words: "Recognizing that the physical world is entirely abstract and without 'actuality' apart from its linkage to consciousness, we restore consciousness to the fundamental position instead of representing it as an unessential complication occasionally found in the midst of inorganic nature at a late stage of evolutionary history."[4] We now know that scepticism in the beginning was a rather naïve though wonderfully useful instrument of human thought. It turned its attention to many crass and unjustifiable assertions made in the name of religion and letting the bright light of its analysis fall upon them did yeoman service to the cause of truth. Such a monumental piece of research as Dr. Andrew D. White's *History of the Warfare of Science and Theology in Christendom* is a study of the utmost interest and on its own level a study of the utmost significance.

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[3] Page 342.

[4] *Ibid.*, p. 332.

It reveals dogmatists blocking the path to free investigation. And it holds them in the deserved if a bit cruel light of its satire. This piece of work needed to be done. And it was important that it should be done unhesitatingly and conclusively. Just so has Dr. White done it.

But the scepticism which punctures the bubbles of arrogant theological dogmatists is only one exercise of that desirable faculty. Dr. Murray in his thoroughly documented book *Science and Scientists in the Nineteenth Century* has applied a shrewd and observant scepticism to the myth of the utterly self-forgetful scientist, completely free from dogmatism and with utterly unselfish devotion to truth. He deals with unhesitating honesty with the fashion in which scientists stood in the way of the advancement of science particularly in the nineteenth century. Thus he renders the service of bringing a mind of clear and potent powers of observation to a fascinating myth which has often led scientists to be more complacent and a bit more self-conscious than it is good for any group of men to be. When once you have been delivered on the one hand from uncritical views of the theologian and on the other from uncritical views of the scientist, you are ready to attack the great problems directly. Enfranchisement from slavery to merely formal authority is a great step on the road to adequate knowledge.

But critical scepticism does its best work when it goes back of dogmatic assertions in respect of the great mechanical systems we find in the universe, and facing the denials of materialistic thinkers becomes sceptical of scepticism itself. To discover the great assertions implicit in destructive denials is one of the most notable services which critical scepticism can render to the world. The truth is that all of us tend to become arrogant dogmatists in the realm of our unanalyzed assertions. We know—or we think that we know—that in many realms we pursue the truth with remorseless candor. And very often we do not suspect the vast regions of unanalyzed convictions which influence so many of our assertions. Many of these convictions may prove capable of maintaining themselves in the presence of that inspection of critical scepticism which brings light not only to dark places but proves able to dissipate the yellow fogs which blur the outlines of our thinking. But very often as in the case of prophets of a mechanistic universe the unanalyzed positions prove to be anything but impregnable. Indeed, the fall of dogmatisms and the breakdown of prejudices is at the moment heard on every hand in really critical scientific thinking. When, as with a whole group of men like Professor Whitehead and Professor Eddington, scientists begin to apply the implements of critical scepticism to their own fields, new vistas begin to open not only in respect of science, but in the whole matter of the interpretation of life.

When critical scepticism has cleared away a good deal of the rubbish scattered about by pseudo-science the spiritual structure of reality begins to be more and more apparent. The points at which certain types of thinkers, who claimed the stately authority of science for their conclusions, have been most curiously and unjustifiably dogmatic, have had to do with just these matters of the assertion of mechanism and the denial of free moving intelligence and spiritual control. When we have seen that all this dogmatism has carried the seed of its destruction in its own heart, we are ready to move out to new and dependable apprehensions as to the meaning of life. The difficulty with the critic is often just that he has not become critical enough. The power of the sceptic becomes most potent when he attains to the mental sophistication and the intellectual finesse which make him capable of being sceptical of his own processes. He will not deny the mechanistic aspects of existence. But he will see and he will assert that only through free intelligence do we become conscious of such mechanistic features as belong to the great system of things, only through free intelligence do we control the machinery we find in existence, only through free intelligence do we make new machines of our own, and only through the same power do we drive them. And this world free and decisive intelligence is by its very nature the world of spiritual control.

III

That master of flashing and penetrating paradox, Gilbert Chesterton, has a fine description of a daring adventurer who sails forth over the seven seas full of the fine lust of discovery. At last after putting in at many ports he discovers a river. He sails up this alluring stream. He comes to a city. He leaves the ship to take possession of the great town and as he lifts his flag he discovers that as the consummation of all his travels he has entered with desperate daring the river Thames, and with the vast courage of a traveler in new lands has at last discovered the city of London. When you approach the ultimate reality of the universe through an analysis of the history of science and all the bold and daring achievements of the great scientists, you feel at first that you are moving upon strange and baffling seas. Clearly the universe must be of a quality which will account for the powers of those darting and observing minds, those analyzing and classifying processes of intelligence, those creative and farsighted activities which have characterized the scientific mind in many a century. Less than this it is impossible to believe. And when we assert as much as this we suddenly discover that this ultimate intelligence, this ultimate freedom, this ultimate will is the very God religion has announced in its most clear moments of insight and understanding. These far journeys of scientific analysis have led us to the spot where we see that personality is the ultimate reality of the universe and spiritual control the final fact of existence.

That noble word "humanism" has been the bearer of many meanings in its long and brilliant and sometimes checkered existence. At the moment there are odd and sincere spirits with many a fine passion who would confine the word to an interpretation of life which can find no place for a great personality exercising spiritual control in the ultimate universe, and sees the humanity which gives the word humanism to the movement only as a by-product of an impersonal universe. It ought not to require much thought to lead to the perception that such a use of a noble and venerable word is a strange perversion. Professor Irving Babbitt rightly deals with a trenchant sharpness with the claim to the great word on the part of those who are not in the tradition of its deepest and most productive meaning. It is surely true that the first step in the nobler humanism is the perception that there is one law for the thing and another law for man, one law for the impersonal world and another for intelligence. The true humanism is based upon that in which we differ from the physical and sub-human worlds and not on that in which we resemble them. And it is surely not only in conformity with the Platonic tradition but in harmony with the serenest insights which result from such studies as have characterized these lectures, when Dr. Paul Elmer More claims for humanism an open door toward those realties which transcend humanity, toward that ultimate intelligence which we dare to believe is one with reality itself. For a critical study of science is one with the higher humanism in pointing to supreme intelligence as the exalted goal of thought. Perhaps there is nothing more significant in the intellectual life of the United States at the moment than the unconscious emasculation of a great word on the part of one group of men, small and sincere and aggressively earnest, and on the other the filling of that great old word with a rich and ample spiritual content. It is not hard to see on which side Erasmus would be in the great contention. And perhaps in some aspects a greater humanist never lived than he. The lack of critical acumen which leads pseudo-humanists to deny the very elements which give permanent significance to humanity and the unconscious assumption of the validity of powers of control which contradict the fundamental positions and contentions of their movement, only makes more clear the need of that critical scepticism which left wing movements so often and so curiously lack. A renewed study of the activities of the scientist will reveal the precarious position of these gentlemen, and will renew our confidence in the ultimate position of the Great Personality of which at best they have no assuring word to say, and which in characteristic mood they are so ready vehemently to deny.

IV

George Brandes devotes one of the chapters of his massive book *Creative Spirits of the Nineteenth Century* to an arresting analysis of the work of Hans Christian Andersen. "Andersen," he says, "does not depict the animal in the human being, but the human in the animal." And later he writes: "Inquire of Andersen how he defines man and he will reply, 'Man is a swan hatched in the "duck-yard" of nature.'"[5] The mind with a keen scent for the genuinely human does not ignore the question of biological origins, but it does insist upon measuring in their own right the significance of values when they have once emerged, and increasingly it feels the necessity of holding views of the universe which conform to these values which are the crown of experience. We have already seen that any universe which has room for the scientist in so far is friendly to the free decisions upon which all morals rest. Now we want to look at the moral life understandingly enough to discover in what precise direction that experience points. And just as a study of those great free persons, the scientists, makes it easier to believe in a great free person controlling the whole vast system of things, so a study of those brave free persons, the moral heroes, makes it easier for us to believe in a great ultimate person in whose nature moral values have their rise and whose own loyalty to his own nature is the source of all moral distinction in the universe. Even Thomas Hardy saw in his inverted way that to think of man as possessing moral ideals higher than God possesses is to make the stream of life rise higher than its source. That the whole history of the moral idealism of the race represents a series of facts as definite as those physical uniformities and changes which Darwin so patiently catalogued we must keep clearly before our minds. Every free and noble act in the whole long story of human life has been a fact of the universe in which it occurred. And we only stultify our own minds when we refuse to admit, in the ultimate universe, kinship with the moral heroism and spiritual beauty which it has so freely produced. The moral experience of man is the gateway to belief in the moral experience of God. All the centuries when noble actions have shamed men upward keep telling us authentic words of the nature of the reality which lies back of the visible world.

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[5] Pages 27 and 29 (Crowell Pub. Co.).

But at this point a very dark and menacing shadow falls upon our path. It is the shadow of all the bitter and blighting evil of the world. It is the shadow of falsehood, and cruelty, and sordid selfishness. It is full of the horror of the sack of ten thousand cities and the wreckage of millions of lives. And as we turn from the shadow to the actuality and face the indubitable blackness of the evil of the world, we hear searching voices which enquire: Since the universe has made place for all this, does not all this in turn reflect the nature of something inherent in the structure of the universe itself? Such a question represents no new challenge. For centuries it has pressed upon the minds of serious men. From the days of the dualism of ancient Persia some men have said: "It is indeed true that evil represents a principle of evil in the universe. But good represents a principle of goodness in the universe. The two are engaged in deadly combat. The good will conquer." The power of the dualistic position to command the allegiance of profound and able men in our own day is seen in the penetrating and distinguished criticism of Dr. Paul Elmer More, especially in the five significant volumes from his pen, dealing with the Greek tradition. On the other hand, for ages certain types of thinkers have thought and written and written and thought to prove that evil is an illusion and good the only reality. It has been a courageous endeavor. But it has scarcely contributed to the moral honesty of the race. Its optimism has been too facile. And it has tended to blur moral distinctions at last.

On the opposite extreme it has been possible to say that evil is the real and good an illusion. But the pertinacity with which unselfish goodness has continued to appear—indeed, the fact that it has appeared at all—has revealed this ultimate pessimism to be as superficial as the facile optimism at the opposite extreme of thought. Taking another position darting thinkers have claimed that the universe is indifferent. The spectacle of existence presents you with a series of events. They are just events. There is no moral interest and no moral quality in the warp and woof of existence. But except as the reflection of a mood of brilliant darkness such a position lacks convincing power. Both the actual good and the actual evil of the world rise up to condemn it. Good is here. Evil is here. We must face these facts and we cannot help ourselves permanently by any verbal legerdemain.

A great deal of ink has been used in describing the dilemma in which we find ourselves if we believe that the universe is ultimately good, when we try to account for the presence of evil. A good deal of ink might wisely be used in describing the even subtler and more baffling problem of trying to account for the presence of goodness in a world essentially evil. The pessimist may seem able at times to foul the nest of the optimist. It is clear enough that by the same token he is unable to build a secure structure of despair for himself. The presence of one good thought breaks the vast fabric of the universal evil. The presence of one good deed challenges successfully the dominance of Giant Despair. If the facts make it difficult for us to be optimists, they simply will not allow us to be pessimists.

One can have only respect for men like Professor Irving Babbitt and Dr. Paul Elmer More who in this whole situation find themselves driven to take a dualistic position. But I for one cannot believe this to be the final word. There is a deep and abiding sense of the necessity of finding moral unity at last in the universe which seems to be quite structural in the mind of man. That this passion carried to extremes does produce a chaos of its own one must admit. But it is possible to accept the good as an indication of the nature of the final reality of the universe, and yet frankly to face the fact of evil and to refuse to call it by any other name. There is mystery here, to be sure, but the mystery is no greater than that which the dualist must face. And after all the more fully we understand the nature of freedom, the more we see that the very price you pay for the good and great things it brings within reach, is the possibility of evil. But the possibility of evil in a world of free personality is a very different thing from the necessity of evil growing out of a stubborn and intractable quality in the structure of reality itself. In any event goodness is here. That is an indubitable fact. And monists and dualists can at least stand together in fighting under its banner.

The very pertinacity of moral ideals is a call to the belief that they come leaping out of the very heart of the universe itself. Moral experience must always claim to reflect the values of the final reality. As we submit to it we too experience the meaning and the quality of spiritual control. The faith which believes in a God who is righteousness alive springs out of the nature of the moral life and is perpetually authenticated in the creative quality of the moral and spiritual experience of the race.

V

Mr. Gorham B. Munson speaking in his volume *Destinations* of the present situation in respect of literary art, declares: "As it is, both writers and readers are in darkness. We perceive our milieu only piecemeal; we are hazy about its origins; and certainly we have scarcely any notion of where it is tending."[6] Our discussion of the æsthetic control of the materials of art has already introduced us into a world of freely accepted values and standards of which such dreary words as those of Mr. Munson need not be uttered. Indeed, when he pleads for the reading and the profound pondering of such critical writers as Paul Elmer More and Irving Babbitt, he is himself reaching out for a world which has ceased to be an experience of flux, where great words have definite meanings, and where we find that standards rightly comprehended and nobly followed enfranchise us and do not at all enchain us.

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[6] Page 2 (J. H. Sears & Co.).

Our study of the artist doing his work at the place where freedom and great standards meet will, however, inevitably carry us beyond art to reality itself. The creative passion whose freedom lies in obedience to noble standards is all the while speaking in the name of beauty. But once and again it takes a deeper tone and we feel that it is speaking in the name of reality itself. The artist with his free loyalty to essential harmonies is reflecting something. Its source is beyond himself. And what is that which he is reflecting? At last it comes to us. He is reflecting the work of that Supreme Artist who has revealed the vast harmonies of his own nature in the subtle harmonies of the world which He has made. Beauty is the nature of God made articulate. The scientist like Kepler can cry, "O God, I think thy thoughts after thee." The man of moral passion who sees the beauty of the moral law may cry, "O God, I would make thy character my own." Jesus himself said, "I must work the works of him that sent me." The great artist sensing the nature of harmony as the very genius of the life of the Deity can cry, "O God, I love beauty with a little fragment of thine own love." The pursuit of truth is a quest which leads to God. The pursuit of goodness is a quest which leads to God. The pursuit of beauty is a quest which leads to God. If we ever enter upon the enterprise of investigating the great things of experience in the light of the conviction that the universe must have a heart of nobility as lofty as the best that it has produced, we cannot fall short of the thought of a God who is goodness and truth and beauty in their perfection, a God whose free loyalty to the truth and goodness and beauty which He finds in His own nature is the ultimate fact of the world.

The sense of beauty is not a static thing. By a law inherent in its nature it will lead us on to a sense of ultimate moral and spiritual harmony in a complete and infinite personal life. Or deprived of this high goal, it will tend to enter into a liaison with sensation whose sheer animal intensity has no place for moral loftiness or spiritual serenity. Beauty moving toward its great goal is not afraid of the body nor does it turn actually from sensation. But while it uses the body, it is not obsessed by the body. And while it accepts and interprets sensation, it always sees sensation pointing to something beyond itself. Just because it finds its resting place in the perfect beauty of the life of God, it is all the more firm in its assurance that it is the very nature of the material to be mastered by the spiritual, the very nature of the temporal to be mastered by the eternal. And the world of personal control which the artist shares with the scientist and the man of moral passion, makes such beliefs seem inevitably a part of one great and harmonious view of the meaning of existence. Thus spiritual control is seen to be a finality which may be apprehended through the normal unfolding of the activities of science, or of morals, or of art. Or best of all, we may come to see that the roads traveled by those whose central attention is devoted to these fields converge. And when they finally meet the destination proves to be the City of God. Thus the view of the universe as centering in a perfect living personality makes possible a synthesis of science and ethics and art in a unity which gives harmony without the loss of essential distinctions, and gives noble variety to life without leading to moral and spiritual anarchy.

VI

Gamaliel Bradford's graphic and searching book on Darwin paints a rather terrible picture of the effect of the Darwinian positions upon the faith of a sensitive young man. There is surely no doubt that the biological doctrine of evolution may be so stated as not only to make faith difficult but also to be full of inner contradictions. And it has become clear that Darwin himself has not said the last word upon many points. Still I take it to be true that the general thesis upon which the biological interpretation rests quite maintains itself. And it ought to be clear to those familiar with a fair amount of the critically significant literature that there is a distinction to be made between the facts involved and the philosophy by which you explain those facts. Granted the facts, you may put them into the form of a mechanical and impersonal philosophy if you will. But the inner contradictions of this position will be likely to turn you to a new appraisal of the whole situation. And then you will be ready to see these facts as part of a personal philosophy which does justice to them and to all the other realities involved.

The whole evolutionary movement has always given to students of some scientific imagination the sense of a process moving toward a goal. Herbert Spencer's celebrated and cumbersome definition of evolution is saturated with a sense of evolution not merely as a series of events, but as a process with a goal. If there is faith implicit in such a view, it is faith without which no doctrine of evolution could exist.

When you come to visualize the appearance and the development of life upon this planet you are, of course, moving in precarious territory. You will, however, be dealing with the pictures the biologists themselves have painted if you observe the emergence of living forms in the water, and their development and diffusion as aquatic beings. But the push of an implicit sense of adventure seems to be part of the very character of living things. By and by life leaves the water and experiments with the land. Vegetation secures a foothold. And after vegetable life animal life makes the astonishing adventure. Time is rushing by all the while. By and by among the trees you see creatures with a strange new light in their eyes. It is the light of intelligence. They are perceiving and knowing and thinking and deciding. Then there comes a day when a splendid wistful sadness is upon their faces. They have sighted the distinctions between right and wrong. The glory of a moral ideal is all about them. They have met the experience which at last is to get for itself in many a language the equivalent of the word *ought*. But other lights and shadows flit over their faces. There has come the sense of the unseen world. There has come the sense of invisible powers. Now begins a long journey with many a vicissitude. One great day men will begin to put the sense of the unseen and the sense of right together. In a little country at the edge of the Mediterranean men will speak of one Great God who is righteousness alive. And at last a person who is the living realization of fellowship with that moral and spiritual life upon which the world rests will walk the shores of Galilee. Men will only be able to account for him as they declare that in him God speaks to men. The whole long process from the first adventure upon land finds new moral and spiritual meaning in his speech and in his life.

It is not that the process explains him. It is not that he even thought about the process. It is that we, knowing the process and knowing him, feel a certain deep and quiet satisfaction in the sense that life has found its goal at last. And now we begin to apprehend the meaning of the whole vast biological adventure. We begin to feel within the universe working in all its manifold aspects a purpose which is alive. So working within the process the Great God has been the defining factor in the movement of evolution. This restless forward push which observers of deep and responsive mind always feel is nothing less than the immanent God perpetually working from within to secure step by step and stage by stage the ends of moral intelligence, the goals of ethical fellowship, and spiritual good will.

Since we only know of the process through the free action of personal intelligence there is evidently an affinity between the process and the intelligence which can discover its relationships and master its forces. The thought of intelligence working within a process which is only known through intelligence, in whose unfolding intelligence appears, and which has no meaning or goal apart from intelligence, really seems to be inevitable. We begin to sense the possibilities of Principal Jacks' seminal phrase "A living universe." Life is a fact we cannot deny. And only in free and creative intelligence does life find any secure or coherent interpretation. The ultimate intelligence is the soul of the universe.

What, then, is the relation of the mass of mechanical uniformities which scientists discover and use to the ultimate personal reality? Let us turn for a moment to the great science of mathematics. Here relations of logical correctness are mental facts quite apart from any existing objects. Mathematics reflects the logical structure of the mind. It is pure rationality apart from matter. But it is also true that every scientific discovery has been based upon the fact that in one way or another objects turn out to conform to these purely rational relationships. It is as if the ultimate mind has put the mark of its own rationality upon the whole system of things. There is an implicit mathematics in the mind. There is an explicit mathematics in the physical universe. And this mathematical structure has no possible explanation apart from an ultimate mind which has given this structure to the physical world. To deny this is merely to admit that explanation is impossible. To assert it is merely to lift the profound correspondence between mathematics as a mental achievement and mathematics as an essential matter in the structure of the universe into such clarity of perspective that we see the ultimate consequences involved. The Great Mathematician has given to the world its mathematical structure.

But we have already seen that it is of the nature of the mathematical system in which we live to respond to the free moving mind which discovers its relationships, and to submit itself to the control of the free intelligence which uses its forces in no end of diverting ways. Thus freedom and uniformity meet in the activities of the scientist as a discoverer. And thus freedom and uniformity meet in all the activity by which practical scientists control the energies of nature, and manufacture all the vast and varied instruments of civilized life. Every automobile and every aeroplane is an illustration of the meeting of freedom and uniformity. It is the very nature of uniformity to be used by freedom. Now when we apply these facts to the ultimate universe we see that the great person who has given to the universe its uniformities must be able to bend them to his own purposes just as the practical scientist teaches the laws of nature to do his will. An automobile represents freedom in law and not freedom from law. Yet its driver is free to go north or south or east or west. The machine has become the vehicle of liberty. So the universe is the servant of the master mind which made the great machine. He achieves his freely chosen purposes by means of the very uniformities which he has established. The ultimate person in the universe must have at least as much freedom in dealing with his great machine as the driver of an automobile or the pilot of an aeroplane. That great machine, the universe, is an instrument of freedom.

All this has the greatest possible importance in respect of the doctrine of prayer. We are not to think of God as being so locked up in the system He has made that He cannot answer prayer. We are reminded at this point of Earl Balfour's men in the London Club sitting at a table in the dining room. There they sat at the very center of a network of almost infinite and certainly incalculable uniformities. Laws to the right of them. Laws to the left of them. Laws above them. Laws beneath them. Laws in them. Uniformity everywhere. One great network of law. And yet one of the men said to the other: "Will you pass me the salt?" And the other —amazing feat of unutterable metaphysical implications—did pass the salt to him. It is of the very nature of freedom to function without embarrassment in a world of law. But the whole philosophy which would make a mechanistic system of materials held in hard and unchangeable chains by grim impersonal necessity goes down every time one man passes the salt to another. The implication in respect of the ultimate universe is clear enough. God must have at least as much freedom as the man who passes the salt to another. The person who is the author of law moves freely among the laws which He has made.

Of course, prayer has its limitations. But the ones we need to remember are ethical rather than metaphysical. God does not play favorites. He does not grant unethical requests. The prayers He heeds must have moral validity and spiritual authenticity. Selfish prayers have a way of failing to reach His throne. But this is because the prayers are selfish and not because God is powerless. God moves freely in all His universe but He is not won by magic formulas and prayers must meet the standard set by Jesus Christ. And prayer must have a profound conformity to the character of God. Sometimes really understanding men open their lips to pray and then turn suddenly silent. It is not because they believe that God has been enslaved by the very system which He has made. It is because they suddenly remember that their prayers do not conform to the spirit of Jesus Christ. And so they flush with shame and are silent. But by and by they will pray without hesitation. And their prayers will be those they can make in full assurance "in His name." They are able to pray because they have come upon prayers which they are able to believe really conform to the character of God. An angel with a drawn sword does stand at the gate of prayer. But that sword is not drawn in the name of impersonal science (if there is such a thing). It is drawn in the name of the ethical standards which reflect the nature of that Great Person, the Living God.

VII

Whenever the pursuit of truth in one field gets separated sharply from the rest of truth, curious and disconcerting things are likely to happen. Such things have often happened in the field which accepts the name of the science of psychology. The study of the subconscious by such investigators as Sigismund Freud seemed to stand on their heads a good many hoary standards and to have little connection with a universe whose ultimate fact was noble spiritual control. The inhibited desire, it seemed, was sent down into the subconscious and did such deadly mischief there that when it was through which its malignant activity one felt that it would have been better to have surrendered to the lawless desire in the first place rather than to have poisoned one's whole inner life by its inhibition. In the presence of such an analysis it was likely to seem a little puzzling that anybody had ever managed to live a life of essential nobility. One was at a loss to account for the high-minded people one had known. The mothers of a psychology where the animal always seems to have the advantage over the spirit of goodness are oddly unlike the mothers who in so many ages have brought moral sweetness and antiseptic vigor to the life of the world.

But leaving such considerations aside, the truth is that no end of Freudians have failed to carry their own principles far enough. It is true that if you just grit your teeth and send a bad desire into the subconscious realm it is likely to cut up ugly capers. It is also true that every time you send a good desire into that subconscious life it spreads a contagion of health about it in that dim underworld of personality. But returning to the lawless desire. Suppose you have a real fight with it. Suppose you fight on into complete and unadulterated joy in the goodness which is the opposite of that evil desire. And suppose that in the very rapture of moral victory you send your gladness down to the subconscious realm. Obviously it will then be a force for loveliness and goodness and will wait for the hour when you need it, ready to bring reinforcement in some later battle for good. Half-fought fights are good for no man. Moral victories fill the subconscious realm with whole battalions of soldiers ready to rise and fight for us in later contests on the arena of the soul's high grim strife.

It may be objected, however, that with all our hard yet happy endeavor the situation is sure at last to be too much for us. And it will be so, we may be told, because the full vigor of whole untold centuries of merely animal life before the rise of moral distinctions lies in the subconscious realm waiting to spring up like a wild beast from its lair. Some day it will get its teeth in our flesh. And then we will know that our fight is in vain. The first reply is an appeal to facts. As a matter of fact, we all know no end of people who have actually proved stronger than the mightiest thrust of physical desire leaping from the grim places of biological inheritance. The very forward thrust of moral evolution is stronger in essential quality than the dark forces with which it contends. We stand at the place where the two forces meet. And we decide which shall be given right of way in our own lives.

But let us look at the situation at its worst. Baffled by personal failure, thrown once and again in the hour of personal temptation, weighed down by evil heredity in the human line, and the flaming inheritance of pre-human years, here stands MAN. And as he listens to the sounds which emerge from his subconscious life he becomes aware of something beneath his personal memories, and his human inheritance, and his dim savage inheritance from far-off centuries of animal life. He becomes conscious that beneath the very flow of his subconscious life there is the pure river of the life of God perpetually flowing. It is possible to break through the floor of the subconscious and let the cleansing waters in. It is possible to appeal from time to eternity. It is possible to appeal from human and animal inheritance to the vast resources of the life of God, which if we will have it so are indeed nearer to us than our own bodies, and closer to us than any potency of animal desire. All this is just an attempt to say by means of figures dimly seen like the shadows in Plato's cave, that spiritual control reaches to every realm analyzed by subtle and adroit pursuers of the strange and evasive ways of the inner life of man. The subconscious may be our foe. But it need not be so, for the Lord of Life is the Lord of the subconscious too. He made it to be a treasure house for the garnered good of the world.

VIII

Mr. Edwin Arlington Robinson, that subtle and melodious prophet of a calm and decadent despair, has edged the wintry gloom of many a dying day with the distant cold light of his unkindling songs. When one turns from his philosophic facing of the glacial age which is descending upon many human spirits to the noble yet grim and beautiful realities of a world in which we dare yet believe that spiritual control is the final fact, the contrast is greater than the difference between day and night. It is the contrast between life and death. In the world of the Great Good Personality which has been the goal of our thought, human personality receives its life from that Divine Personality who is the ultimate fact of the universe. And to man is given the great and dangerous gift of spiritual control. He may misuse it. He has misused it. And so moral evil has entered the world. It is more comfortable to think of oneself as a victim than as a sinner, and so the thought of natural evil for which we are not responsible is more pleasant than the thought of moral evil which is our own creation. But the evil which is original in the sense that we originate it, is the fundamental ethical matter. And the possibility of this—the possibility which we have turned into grim actuality—is a by-product of the glorious heritage of personality itself.

Such insights as this soon fling us into the heart of the type of moral and spiritual experience glowing in the Old Testament life and coming to glorious flower in the life reflected by the New. The Hebrew prophets belong to a world of personal and spiritual control. You can scarcely conceive of such a world without the vast yet intimate consummation which found expression in the personality of Jesus. You cannot think deeply of moral evil in a personal world as a thing to be grappled with and conquered by personality, without thinking of the dark and terrible beauty of the Cross. You cannot think of moral and spiritual experience with endless vicissitudes of failure and triumph moving on through ages and finding some sort of genuine record, without thinking of such documents as those in the Old Testament. And the consummation of moral and spiritual experience in Jesus would have been in-complete without its literary expression in the New. The two bodies of writing grow out of experience. To experience they speak. By experience they must be met. Life itself—life based on personal consciousness and personal decision—is the judge by whom they have been given supreme place among the world's writings for the moral and spiritual guidance of mankind. But the personal qualities of life we have seen in the scientist, the moral battler and the artist, and of which we have seen flashing glimpses in our thought of that great ultimate person, the Living God, once becoming a part of human experience, have a right of way all their own. Waning personality lifts sad questions. But personality growing in moral and spiritual power, in intellectual acumen and in the sense of the great and gracious harmonies which give beauty to experience, has something dauntless and masterful about it. Death seems an impertinence in its presence. If you really apprehend the meaning of personality, it is almost inevitable that you will believe in immortality.

All this suggests not this short treatment, but a library of volumes of closely knit argument, dialectic and interpretation. And even that would not be an achievement of the sort of proof which amounts to demonstration. Indeed, there is no place for demonstration in a personal world. There must be large enough areas of question to make room for intellectual candor, for moral adventure, and the taking of spiritual risk. So there is room for the soul to wake and grow. But it is possible for us to see that an impersonal world would be an irrational world. And it ought not to be too hard for us to come to the indubitable conviction that any world where science is possible is a world where personality is supreme.

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